## Critical Opinions Regarding the First Edition of the Present Work, which Was Issued under the Title of "Illogical Geology" (1906)

"I have been intensely interested in your 'Illogical Geology,' and I think you prove your points conclusively."

THE REV. S. BARING-GOULD,
*Author of "Onward, Christian Soldiers."*
*Lew Trenchard, England.*

"It is a very clever book." DAVID STARR JORDAN,
*President of Leland Stanford University.*

"I do not see why the argument is not scientific and demonstrative. It seems to me that you have demonstrated the hopelessly unscientific character of the hitherto accepted geological notions."

PROF. WILLIAM CLEAVER WILKINSON,
*University of Chicago.*

"My first impression of the work is that it may serve a useful purpose in orienting geologists as to the correct appearance of their views upon the leading problems of the science.

"As a geologist, I some time ago ceased to theorize. I am simply noting facts and trying to explain them." C. W. HALL,
*Professor of Geology and Mineralogy, University of Minnesota.*

"I must confess that I have never read anything clearer and more convincing on the subject. It seems to me final, so far as the evolutionary theories and claims go." WILLIAM G. MOOREHEAD,
*President of Xenia Theological Seminary, Xenia, Ohio.*

"The book ought to have a place among college text-books."

PROF. LUTHER T. TOWNSEND,
*Boston University.*

"There are many things in your book which start reflection, and show how far we are from having yet attained settled results in the study of the rocks. . . . I shall probably hear more of your book as time goes on." PROF. JAMES ORR,
*United Free Church College, Glasgow, Scotland.*

"I think you have brought out with great clearness the difficulties of supporting the evolution theory from the geological side."

PROF. GEO. HOWARD PARKER,
*Department of Zoology, Harvard University.*

"Many thanks for your book, which I have read with much interest. . . . Sir H. Howorth's arguments from the presence of herds of mammoths, etc., in places where they must have been overwhelmed by a sudden catastrophe, have always seemed to me very strong, and have never yet been answered by 'orthodox' geology." PROF. A. H. SAYCE,
*Oxford University, England.*

"It is a remarkable piece of logical reasoning. You are a cogent writer, and I am glad we have you on the side of 'primal orthodoxy.'"

PROF. FRANKLIN JOHNSON,
*University of Chicago.*

# The

# Fundamentals of Geology

## And Their Bearings on the Doctrine of a Literal Creation

By

GEORGE McCREADY PRICE, B.A.

Professor of Geology, College of Medical Evangelists, Loma Linda, California; Author of "Outlines of Modern Science and Modern Christianity" (1902), "God's Two Books" (1911)

It is a singular and a notable fact, that while most other branches of science have emancipated themselves from the trammels of metaphysical reasoning, the science of geology still remains imprisoned in "*a priori*" theories.—*Sir Henry Howorth: "The Glacial Nightmare and the Flood," Preface 7.*

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*TO THE MEMORY OF*

*Lord Francis Bacon and Sir Isaac Newton,*
*men who realized most clearly the true objects of*

*NATURAL SCIENCE,*

*the methods by which it should be pursued,*
*as well as its limitations,*
*and under whose wise guidance*
*all that is substantial and enduring*
*in modern science has been discovered,*
*this book is reverently dedicated by*

*THE AUTHOR*

# PREFACE

WHAT may be called the first edition of the present work was printed in the summer of 1906 under the title of "Illogical Geology." It was only a pamphlet, and was intended only as a sort of trial edition, being circulated privately by the author for examination and criticism, some five hundred copies being distributed gratuitously among the geologists and other scientists of this country and England. A large number of replies were received. The president of one of our greatest universities, who is rightly considered the leading authority in one department of zoology, wrote the author some six letters in defense of the popular theories; but he presented nothing in the way of argument that had not been considered in "Illogical Geology," and closed the subject by saying that he did not see "anything very amazing" in my Five Facts. But the replies from other illustrious scholars of international reputation have encouraged the author to believe that these Facts, as well as the whole general argument, absolutely demand a reconstruction of geological theory; and under this belief this preliminary outline has been revised and extended into the present volume, the changes warranting also a change of title.

No one was more painfully conscious of the crudeness and imperfections of the first edition than was the author. But it served its purpose in shaping up the subject; and the criticisms of many friends have been helpful in showing how it ought to be improved. However, the corrections and enlargements here presented have come chiefly from important discoveries that have since been made.

Perhaps of first importance among the latter should be mentioned the great increase in our knowledge of the so-called faulted area in Montana and Alberta, where several thousand square miles of Cambrian or Pre-Cambrian rocks occur, often apparently conformably, on the Cretaceous (see frontispiece). Bailey Willis and others had

already studied the southern portion of this area in Montana, though their work was unknown to the author; but it is only quite recently that the mountains of all this vast area have been studied together, with the result that similar conditions are now known to prevail over a district some 350 miles long from north to south, and about twenty or twenty-five miles from east to west. These things, with other discoveries elsewhere, have made it necessary to rewrite completely chapter 5; while a number of photographs have been added to help make the subject clearer. It now looks as if this very striking example of Palæozoic rocks quite obviously deposited in a natural way on top of Cretaceous over an immense extent of country, may do more than the hundreds of quite similar examples elsewhere have hitherto been able to accomplish in compelling a complete reform in geological theory.

Another important event since issuing "Illogical Geology" has been the publication of the English translation of the great work of Eduard Suess, "The Face of the Earth," with which the author had been acquainted previously only in an indirect way. For those who are familiar with this masterly work, it will be unnecessary to call attention to the many ways in which it confirms the positions taken in the first edition of the present work regarding (1) the radical differences between the ancient strata and the deposits now forming in our modern oceans, (2) the absolute fixedness of our present continents since the beginning of scientific observation, and hence (3) the hopelessness of trying longer to explain these ancient deposits on the basis of uniformity. Indeed, this work of Eduard Suess, who is perhaps the greatest of living geologists, may well be called the epitaph of the doctrine of uniformitarianism.

Professor Suess alludes to "the remarkable fact that it has been found possible to employ the same terminology to distinguish the sedimentary formations in all parts of the world." (Vol. 2, p. 540.) He reverts to this problem again and again, as if troubled by this modern form of the onion-coat theory; and finally, in putting it in the form of a question, which he considers one of the greatest prob-

lems of geology, as to how one of these formations "recurs in parts of the earth so widely removed from one another, . . . always attended by such characteristic features," and how it comes that even the more minute "stratigraphical subdivisions extend over the whole globe" (Vol. 1, p. 8), he says that "if we could assemble in one brilliant tribunal the most famous masters of our science, and could lay this question of the student before them, I doubt whether the reply would be unanimous, I do not even know whether it would be definite."

And he closes by acknowledging that if the student were to seek an answer to this great problem in "The Face of the Earth," "*he would not find in it an answer to his question.*" (Vol. 1, p. 15.)

But how easily this "remarkable fact" is explained when we once realize that the geological series of life has no time value whatever, but simply represents an old-time taxonomic series! That its terminology has proved to be universally applicable is the most natural thing in the world; while the fact that certain formations comprising the lower types of life are to be found all over the world is also just what we should expect from the almost universal extension of similar forms of life to-day.

A great deal has been written of late regarding the antiquity of Man in Europe, the more interesting part of it dealing with the large number of drawings that have been found on the walls of caves in numerous places in Southern Europe. But the author has not felt like materially revising his argument on this point in order to embody these more recent discoveries, for his confidence in the real antiquity of most if not all of them has grown steadily less with the passing years, and like the artificial distinctions made in glacial geology, the following up of the results of such subjective methods becomes a weariness of the flesh. When every layer in a sand-bank calls for a new age, and every peculiarity on a skull or a femur demands a new Latin name to characterize the particular species of the genus *Homo* represented, it would seem as if pseudo-scientific speculation could not well go much further; but until something more substantial is accomplished in the

way of discovering human remains, it has seemed best to leave the argument as first written. Some day we may discover something regarding the men of that ancient world that will make it worth while to rewrite this part also.

The first chapter has been wholly rewritten, in order to make the rather intricate matter of the *a priori* argument clearer to the general reader. The part of the Appendix dealing with the subject of Creation has also been rewritten and strengthened, as what was said on this point in the first edition was entirely too timid and weak in the light of the logic of the preceding argument; for if the scientific induction from Parts One and Two be sound, a literal Creation, such as Christianity teaches, is the only possible conclusion of a rational mind.

With the firm conviction that the night of cosmological speculation has nearly passed, and that the day of true inductive geology is about to dawn, this little work is sent forth with the request that its readers will view charitably the mistakes and shortcomings that can scarcely be avoided in a pioneer work like this, which attempts to reconstruct so comprehensive and so highly developed a science as geology.

THE AUTHOR.

*Loma Linda, California, January, 1913.*

# *INTRODUCTION*

DURING the last quarter of a century or so, all the physical and biological sciences have experienced a most astonishing development. In most of them the rapidly accumulating discoveries have necessitated a readjustment or even the complete abandonment of long-cherished theories to make room for these troops of newly discovered facts. For as one of our leading physicists has remarked, "Directly a fact refuses to be pigeonholed, and will not be explained on theoretical grounds, the theory must go, or it must be revised to admit the new fact." (Sir William Crookes, "Living Age," Vol. 238, p. 318.) In other words, facts must always have the right of way over theory. And in any healthy science, the fundamental theories are always kept well adjusted to all the new discoveries; for whenever this is not done, a science soon gets in a comatose condition. But why is it that for nearly a century geology alone has never revised its fundamental theories? Is it a remarkable instance of perfection from the beginning, or is it a case of arrested development?

Geology is often spoken of as one of the youngest of the sciences. This is a mistake; for as Zittel has shown, some of the most fundamental theories of the science were well formulated long before the most essential facts in the related sciences were known. Thus the theories of the igneous origin of the crystalline rocks "had been laid without the assistance of chemistry," and before anything was known of the microscopic structure of these rocks. ("History of Geology and Palæontology," pp. 327, 341.) And in the same way the whole series of fossil plants and animals had been blocked off and even the details pretty well fixed previous to 1820, or before anything of importance was known of any class of living animals save Mammals. (*Id.*, pp. 128-137.) But is it not incredible that this science, the one above all others dependent upon the

results of the other sciences both physical and biological, should thus by some happy chance spring into existence full-grown long in advance of the others, and never need any adjustment or revision thereafter?

I do not for a moment wish to intimate that during all this period geology has made no advancement, or that no important discoveries have been made. There have been plenty of such discoveries. And there is just where the trouble comes; for thousands of facts have accumulated, but there have been no pigeonholes to accommodate them. If the theoretical part of the science had been kept adjusted to these new facts as fast as they were discovered, there would not now be this urgent need of completely reforming the science — a reform that seems to many like a revolution, though it might have been accomplished gradually in a peaceful manner. But the theoretical part of this science has proved so inelastic, so incapable of adjustment, that it seems as if nothing but the violence of a complete reconstruction can now provide room for these new facts to which admittance into the old system has been refused, and for which no pigeonholes have ever been provided.

But I think that I realize the seriousness of the task here suggested, and that an attempt to reconstruct the whole basis of geological theory must appear to many people like a tilt against a windmill. And no doubt a bald summary of my general conclusions, if given here at the beginning, may deter many a prospective reader from any further examination of this book. And yet at this imminent risk of thus cutting off these inquirers, I think I must, in justice to those who may persist in reading further, give a brief summary of the argument to be found in the following pages.

Darwinism as a part, a minor part, of the general evolution theory, rests logically and historically on the succession-of-life idea as taught by geology. If there has actually been this succession of life on the globe in a very definite order, then some form of genetic connection between these successive types is the intuitive conclusion of every thinking mind, even though it may prove impossible to recover the connecting-links. But if there is absolutely

no evidence in either logic or objective fact that certain types of life are intrinsically older than others; in other words, if this succession of life is not an actual scientific fact capable of the clearest proof; then Darwinism or any other form of biological evolution can have no more scientific value than the vagaries of the old Greeks; in short, from the view-point of true inductive science, it would necessarily be a gigantic blunder, historically scarce second to the Ptolemaic astronomy.

In Part One the writer has examined critically this succession-of-life theory. It is improper to speak of my argument as destructive, for in neither the history nor the logic of that theory has there ever been any real constructive argument to be thus destroyed. My argument is essentially an exposure; and I am confident that few, after carefully reading the following pages, will continue to think that geology has really proved certain kinds of fossils to be older than others, or that "historical" or stratigraphical geology as commonly taught is an inductive science in any proper sense of the word.

In Part Two I have brought forward some of the chief facts bearing on the doctrine of uniformity. The latter has had at least some excuse for existence in the theory of the science, as it is quite the logical and scientific thing to assume as a working theory that natural processes and changes took place in the past as they are now observed to take place, *until we find positive evidence to the contrary.* The works of Suess and Howorth are models of transparent logic, and have furnished us a part at least of this positive evidence to the contrary, dealing with "the great dividing line" between the ancient deposits and the modern ones; and taken together they have demonstrated conclusively and for all time that there is nothing now going on in our modern world at all explanatory of even the last and least of these great geological changes of the past. But it is obvious that, with the facts before us which are enumerated in Part Two, most of which have been before the world for half a century or more, there would never have been any question at all regarding the manner in which these astonishing changes must have taken place, if the succession-

of-life theory had not precluded a candid examination of the fossil world *as a unit* by throwing it into an artificial perspective, where, instead of looking at this fossil world as a whole, we have been taught to view these alleged successive assemblages of life forms arranged one after another in single file; and by these methods there has never yet been any truly inductive or scientific examination of the facts of palæontology in their entirety. But the facts enumerated in Part Two, namely, (1) the abnormal character of most of the fossiliferous deposits, (2) the sudden, world-wide change of climate they record, (3) the marked degeneration in all the organic forms in passing from the older to the modern world, together with (4) the great outstanding fact that human beings, with thousands of other living species of animals and plants, have at this great world-crisis left their fossils in the rocks all over the globe,—these facts, I say, when looked at together as a cumulative argument, prove beyond a possible doubt that our once magnificently stocked and climated world met with a tremendous catastrophe some thousands of years ago, before the dawn of history; and they confirm in a marvelous way the Biblical record of a universal Deluge, which has so burned itself into the memory of the race that the tradition of it survives among every race on earth.

I have not attempted to decide even approximately how long ago this great world catastrophe took place. Many natural phenomena considered singly would seem to indicate that it must have been a very long time ago; but we can not hope to settle such a matter in a scientific way, and the sad experience of former blunders ought to teach us modesty and caution. All that we can say with absolute positiveness is that *it occurred since Man appeared on earth.* Archæology, history, and Bible chronology may furnish us an approximate date; but no method hitherto devised of reading time from the rocks has much scientific value.

As for the origin of the living things that existed before that event, we can nevermore evade the tremendous fact of a *literal Creation,* since modern science has forever outgrown the idea of spontaneous generation, and in the light of the facts here brought out there is absolutely nothing

upon which to build a scheme of evolution, since inductive geology is utterly unable to show that certain types of life originated before others. With the myth of a life succession dissipated once and forever, the world to-day stands face to face with *Creation as the direct act of the infinite God.*

However, it would be a very hasty and superficial view of the matter that would see in all this the ruin or the disorganization of the science of geology. For what is here brought out does not by any means demand that the present orderly arrangement of the fossils, built up with so much conscientious care, should be disarranged or set aside. For we can easily work with and speak of these fossil forms without being in any way biased or embarrassed by the traditional age-values so long associated with them. Let the geological series stand by all means. It is a good taxonomic or classification series of that ancient world, and will be indispensable in the future reconstruction of geology on a truly scientific or inductive basis, by which reconstruction only may we hope to reproduce a more or less faithful picture of that marvelous world which man once beheld, but whose ruins now lie buried deep beneath our feet.

With regard to the geological names of formations, I have not ventured to suggest any changes, though a few such changes must necessarily come in the course of time. But by *Silurian, Devonian, Triassic,* etc., we of course only mean rocks containing certain kinds of fossils; and as most of the names of systems and groups are geographical in origin, they are *per se* neutral as to theory, and will doubtless endure the test of time. In this respect they conform to the standard set by Huxley when he demands names expressing merely "similarity of serial relation, and excluding the notion of time altogether." The names of the series, "Palæozoic," "Mesozoic," and "Cænozoic," as well as the name "Tertiary," are decidedly objectionable as embalming the fancies of a discarded hypothesis, and will probably have to give place to others that express no theory as to age or origin. But I have retained them here, as Dana says of "Tertiary," "simply because of the convenience of continuing an accepted name." Chemistry and

astronomy still carry many names surviving from the old fooleries of alchemy and astrology, and perhaps geology can hardly expect to fare much better.

Some may object that the present work is too exclusively critical and destructive. But when an objectionable building already occupies the ground, some destructive work is necessary before a better structure can be erected in its place. This work of destruction is never a pleasant task, and the writer sincerely wishes that in the present instance the clearing of the ground had fallen to the lot of some one else. He is especially sorry that in the present incomplete state of the reconstructed science it is not possible to give a complete statement of formal inductive geology. But so far as the present work is constructive, there is one virtue that can rightly be claimed for it. It is at least an honest effort to study the foundation facts of geology *from the inductive standpoint;* and whether or not the author has succeeded in outlining a true inductive method, it is, so far as he knows, *the only work of modern times in the English or any other language which does not treat the science of geology more or less as a cosmogony.*

That such a statement is possible is, I think, sufficient to justify me in giving the volume to the public. It would seem as if the twentieth century could afford at least one book on geology built up from the present instead of being postulated from the past.

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# *Illustrations*

# PART ONE

## CRITICISM

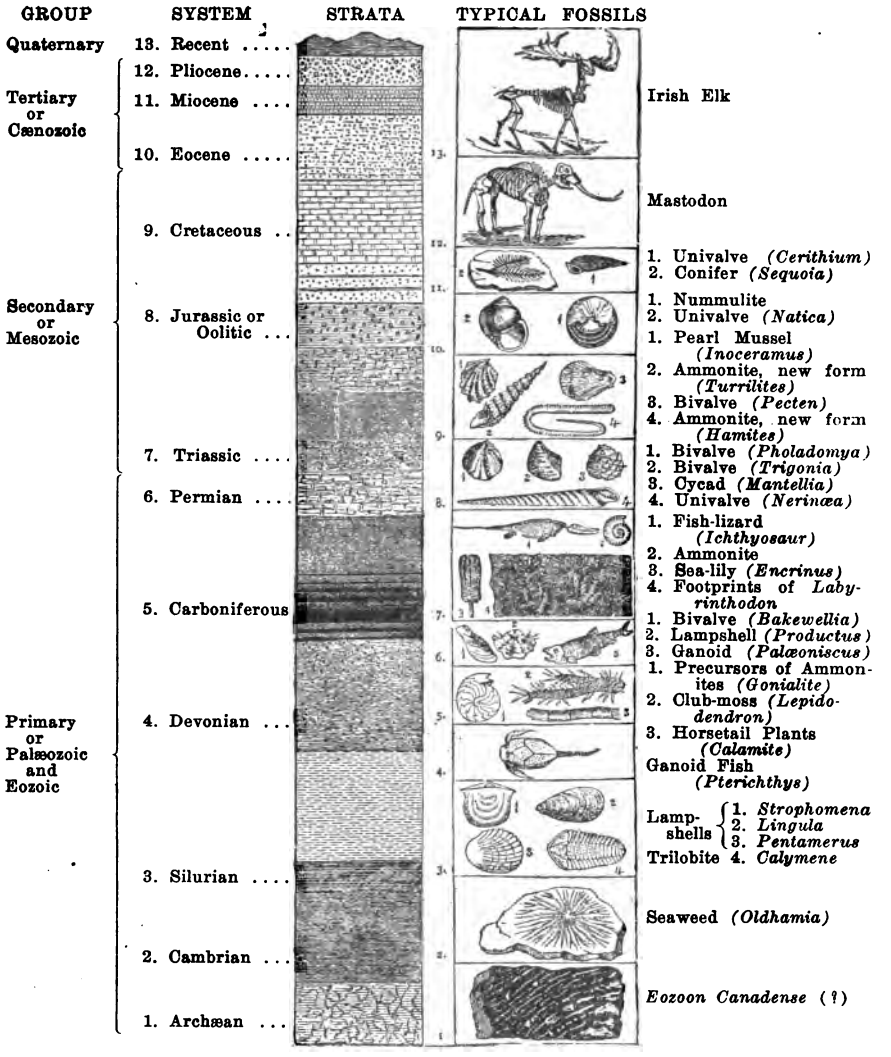



FIG. 2 — TABLE OF STRATIFIED ROCKS, WITH TYPICAL FOSSILS

# CHAPTER I

## The Modern Onion-Coat Theory

GEOLOGY deals with the past history of the globe, and the changes that have taken place upon it. The records upon which we must depend for reading this history are the rocks and their fossil contents. A correct interpretation of this rocky record must furnish us with a faithful picture of what has taken place on the globe since life has been upon it. Such a study, pursued according to inductive methods of investigation and correct principles of logic, must constitute the true science of geology.

But the universal modern method in geology, as taught in our colleges and universities, is to start with an imaginary beginning of things, say with our earth a cooling globe, and by a pseudo-scientific method attempt to describe the order of the subsequent events down to our day. The criticism of this as violating the fundamental principles of inductive science, together with suggestions as to the reconstruction of a truly scientific method of geological research, will be reserved for a subsequent chapter (chapter 13, "SCIENTIFIC METHODS"). Here we must confine ourselves to the abstract idea of the successive ages themselves, which constitute so much of geology as currently taught, and consider whether

or not the details of such an idea are scientifically conceivable, whether the general fact of there having been these successive ages of particular life forms is proved or merely assumed, and what bearing this idea has upon subsequent methods of scientific study.

First we must note how the age of any newly discovered deposit is determined by modern geologists.

On coming to any region that has not yet been examined and described, the investigator first determines the stratigraphical relationship of the various strata, following them as far as possible, noting any changes in the beds themselves, and especially in their fossil contents. These strata are then classified off into groups, called formations, indicating successive ages; but the names given them are at first merely local geographical names, and have but a local or note-book value, until the fossils they contain have been carefully compared with those of other regions. When this is done, the local names may give place to others more generally accepted elsewhere, and thus these beds are assigned a definite place in the long series of successive ages, and we are confidently informed of the particular period of geological history at which they were formed.

Our object now is to determine whether this method of fixing the age of a rock deposit is in all respects a scientific one, conformable in all essentials to the methods pursued in other sciences, such as physics, chemistry, and astronomy. If we can be sure that there has been this succession of life on the globe, if we can be certain of just what types

of life only were in existence at certain periods, and that other types of life were *not* then in existence, we may feel sure of the age of a newly discovered rock deposit by comparing its fossil contents with those of this series as already determined. *But how did scientists first determine this order of successive life forms?* Or how may we now prove in logical, scientific fashion that there has actually been this succession of life on the globe in a particular order? To illustrate the matter, How are we to prove that when the Cambrian forms were existing in one locality, let us say New York, this assemblage of plants and animals must have prevailed everywhere on earth, or at least that no other higher types, such as Vertebrates, or Mammals, or men, were then in existence anywhere else?

At the present time, in our modern lakes, seas, and oceans, samples of every grade of life are being buried for fossilization in different localities,—Worms, Mollusks, Crustaceans, Insects, Reptiles, Amphibians, Fishes, Mammals, and human beings, all are now being made candidates for fossilization. How are we to prove in a scientific way that this was not always the case? How can we, by scientific methods, get back of the time when all these forms of life existed contemporaneously? How can we, except by assuming a supernatural knowledge of the past, fix on a time when only a few of the lower forms existed on the globe? The current geological theories say that there was such a time, and the whole science as commonly taught, and indeed the

whole scheme of biological evolution, rest on the supposition that such was the case. But how are we to prove such a statement in scientific fashion, or justify it in the light of reason as an intelligent and reasonable idea?

To some it may seem like a very extravagant statement to say that in the whole field of scientific study there is to-day nothing else of such tremendous importance and far-reaching consequences as is the determination whether these successive ages are scientific fact or mere speculation. But when we remember that all the subsequent facts of geology gather themselves about this idea, and that the whole scheme of biological evolution is built up on these successive ages, such a statement of the importance of this problem will appear natural and reasonable.

From an examination of the literature of geology and palæontology during the last century or so, it will be seen that very few writers have thought enough along this line to leave us ten sentences upon the subject; while only four, Spencer, Huxley, Nicholson, and Suess, with possibly one or two others, have written anything of importance or have even attempted to sound the logical bottom of the problem. It will be convenient to consider what each of these men has said upon the subject.

Herbert Spencer[1] did not seem to think the way in which this idea has been built up a very praiseworthy example of the methods to be pursued in natural science.

[1] "Illogical Geology; Illustrations of Universal Progress," pp. 329-380; D. Appleton & Co., 1890.

He starts out with Werner, of Neptunian fame, and shows that the latter's main idea of the rocks always succeeding one another over the whole globe like the coats of an onion was "untenable if analyzed," and "physically absurd," for among other things it is incomprehensible that these very different kinds of rocks could have been precipitated one after another by the same "chaotic menstruum."

But he then proceeds to show that the science is "still swayed by the crude hypotheses it set out with; so that even now, old doctrines that are abandoned as untenable in theory, continue in practise to mold the ideas of geologists, and to foster sundry beliefs that are logically indefensible."

Werner had taken for his data the way in which the rocks happened to occur in "a narrow district of Germany," and had at once jumped to the conclusion that they must always occur in this relative order over the entire globe. "Thus on a very incomplete acquaintance with a thousandth part of the earth's crust, he based a sweeping generalization applying to the whole of it."

Werner classified the rocks according to their mineral characters; but when the fossils were taken as the prime test of age, the "original nomenclature of periods and formations," says Spencer, kept alive the original idea of complete envelopes encircling the whole globe one outside another like the coats of an onion. So that now, instead of Werner's successive ages of sandstone making or limestone making, and successive suites of these rocks, we have successive

how are we to set limits to the possible diversity of these contemporary forms? But the current system of geology *denies that very diverse types could have been living contemporaneously in the long ago;* hence we must own that we have this modern form of the onion-coat theory, a real biological onion-coat theory, taught as science in practically every college and university throughout the civilized world.

Spencer then examines at considerable length the kindred idea that the same or similar species "lived in all parts of the earth at the same time." "This theory," he says, "is scarcely more tenable than the other."

He then shows how in some localities there are now forming Coral deposits, in some places Chalk, and in others beds of Mollusks; while in still other places entirely different forms of life are existing. In fact, each zone or depth of the ocean has its particular type of life, just as successive altitudes have on the sides of a mountain; and it is a dogmatic and arbitrary assumption to say that such conditions have not existed in the past, or to limit in any way the diverse varieties of life that may then have coexisted in widely separated localities.

On our own coasts, the marine remains found a few miles from shore, in banks where Fish congregate, are different from those found close to the shore, where only littoral species flourish. A large proportion of aquatic creatures have structures that do not admit of fossilization; while of the rest, the great majority are destroyed, when dead, by the various kinds of scavengers that creep among the rocks and weeds. So that no one deposit near our shores can contain anything like a

true representation of the fauna of the surrounding sea; much less of the coexisting faunas of other seas in the same latitude; and still less of the faunas of seas in distant latitudes. Were it not that the assertion seems needful, it would be almost absurd to say that the organic remains now being buried in the Dogger Bank can tell us next to nothing about the Fish, Crustaceans, Mollusks, and Corals that are now being buried in the Bay of Bengal.

Herbert Spencer entitled his essay, "Illogical Geology," and he evidently found it difficult to keep within the bounds of parliamentary language when speaking of the absurd and vicious reasoning at the very basis of the whole current geological theory; for, unlike the other physical sciences, the great leading ideas of geology, such as uniformity, the succession of life, etc., are *not* generalizations framed from the whole series or group of observed facts, but are really dogmatic statements supposed to be axiomatic, or at the most *very hasty conclusions based on wholly insufficient data,* like that of Werner in his "narrow district of Germany." Sir Henry Howorth[2] has well expressed the urgent need there is of a complete reconstruction of geological theory:

> It is a singular and a notable fact, that while most other branches of science have emancipated themselves from the trammels of metaphysical reasoning, the science of geology still remains imprisoned in *a priori* theories.

Evidently this author had a clear view of the fundamental difference between geology as it is, and geology as it ought to be; between subjective speculations based on *a priori* reasonings about an imaginary beginning of things, and real inductive science,

[2] "The Glacial Nightmare and the Flood," Preface 7.

the result of an indisputable generalization from the sum total of observed facts. The former is the scholastic method, the latter the Baconian method; and nothing further is needed to show what an anachronism the current cosmological geology is among the group of regenerated modern sciences — a fossil science, an out-of-date method, a survival of a bygone age.

But Huxley[3] also has left us some remarks along the same line which are almost equally helpful in showing the essential absurdity of the assumption that when one type of life was living and being buried in one locality another and very diverse type could not have been flourishing in other distant localities,— in other words, the absurdity of this modern onion-coat theory.

This is how he expresses it:

> All competent authorities will probably assent to the proposition that physical geology does not enable us in any way to reply to this question: Were the British Cretaceous rocks deposited at the same time as those of India, or were they a million of years younger, or a million of years older?
>
> *All that geology can prove is local order of succession.* It is mathematically certain that, in any given vertical linear section of an undisturbed series of sedimentary deposits, the bed which lies lowest is the *oldest*. In many other vertical linear sections of the same series, of course corresponding beds will occur in a similar order [?]; but, however great may be the probability, no man can say with absolute certainty that the beds in the two sections were synchronously deposited. For areas of moderate extent, it is doubtless true that no practical evil is likely to result from assuming the corresponding beds to be synchronous or strictly contemporaneous; and there are

[3] "Discourses Biological and Geological," pp. 279-288.

multitudes of accessory circumstances which may fully justify the assumption of such synchrony. *But the moment the geologist has to deal with large areas,* or with *completely* separated deposits, the mischief of confounding that "homotaxis" or similarity of arrangement which *can* be demonstrated, with "synchrony" or identity of date *for which there is not a shadow of proof,* under the one common term of "contemporaneity," becomes incalculable, and proves the constant source of gratuitous speculations.

Yet even so clear a thinker as Huxley usually was, does not seem to have had more than a twilight vision of the real questions involved in this modern onion-coat theory. For it is not a question of whether the British Cretaceous fossils lived contemporaneously with the Cretaceous of India. No doubt they did; for the human mind instinctively believes that representatives of the same types of life, no matter how distant geographically, must have been connected in time and must have been related to one another by descent. But it is really the converse of this proposition that needs to be critically examined; namely, the assumed denial that *very dissimilar* forms in England or India or America were also contemporaneous. The doctrine of Creation says that they were thus contemporary, while the theory of successive ages denies it; for it is useless to talk about distinct geological ages, if dissimilar types were contemporary in the long ago as they are to-day.

Huxley, indeed, seems to have caught a glimpse of the absurdity of denying that there must have been zoological provinces in the long ago, for he says:

A Devonian fauna and flora in the British Islands *may* have been contemporaneous with Silurian life in North America, and with a Carboniferous fauna and flora in Africa. *Geographical provinces and zones may have been as distinctly marked in the Palæozoic epoch as at present.*

Certainly; but if this be true, it is equally certain that the Carboniferous flora of Pennsylvania may have been contemporaneous alike with the Cretaceous flora of British Columbia and the Tertiary flora of Germany and Australia. *But in that case what becomes of this succession of life* which for nearly a century has been the pole-star of all the other biological sciences — I might almost say of the historical and theological as well?

Must it not be admitted that in any system of clear thinking this whole idea of there having really been a time when only a certain limited number of life forms were in existence, and these more or less universally distributed over the whole globe, is not only *not proved* by scientific methods, but that it is essentially unprovable and absurd?

Huxley, in point of fact, admits this, though he goes right on with his scheme of evolution, just as if he never thought of the logical consequences involved. His words are:

In the present condition of our knowledge and of our methods *(sic)* one verdict —"*not proven and not provable*"— must be recorded against all grand hypotheses of the palæontologist respecting the general succession of life on the globe.

These remarks of Huxley's, indeed, were so near to the whole truth of the matter that it almost seemed as if geology would follow the example of the other

sciences by emancipating itself from the trammels of metaphysical speculation, and donning the garb of demonstrated fact; but it appears that his criticisms only served to awaken the theorizers long enough to use this new light about zoological provinces and districts to help them out of some minor puzzles into which their theory had led them; for outside of a few admiring references to this idea of "homotaxis," subsequent writers have seen in them nothing suggestive of the miserable logic on which the whole theory of successive ages, and thus the evolution doctrine also, has been built up.

Prof. H. Alleyne Nicholson ("Manual of Palæontology," General Introduction, pp. 47, 52, 3d ed.) is almost the only other writer who has considered it worth while to try to defend this doctrine of successive ages; and we must next note some of his remarks illustrating how near this idea of projecting our modern conditions of geographical distribution back into the past came to wrecking the inherited onion-coat theory, the spirit of which, Spencer says, is still traceable, "under a transcendental form, even in the conclusions of its antagonists."

"When it had been clearly established," says Nicholson, "that particular groups of strata in Europe were characterized by particular assemblages of animals and plants, it was, not unnaturally, concluded that similar or identical assemblages of organisms would be found to characterize corresponding groups of strata all over the world. This led to the idea that the successive faunæ and floræ ob-

servable in the area first examined had been *universally distributed over the whole globe* [that is, the onion-coat theory was still retained]; from which followed the old catastrophic view that the close of each geological period had been signalized by a more or less complete extinction of the animals and plants then in existence, and that a new fauna and flora had been introduced at the commencement of each succeeding period."

He continues:

> It is, however, now universally admitted that in nature the chronological succession of rocks, as determined by fossil remains, *is local and not universal,* in the sense that the precise order of phenomena must necessarily have differed in different regions. That this must be so is proved by the existence at the present day of "zoological provinces"; by the fact that dry land and sea must always have existed since the beginning of Palæozoic time at any rate, and that sedimentation can, therefore, never have been universal; and by the certainty that the sedimentary deposits now in process of formation, and therefore necessarily coeval, contain the remains of *dissimilar* groups of animals and plants.

Page after page is devoted by this author to enlarging on this principle of true science, which teaches us that dissimilar groups of life are now coexisting in separated localities, and that if we hold fast to real experience, and project our modern conditions of geographical distribution back into the past until we find positive evidence of the contrary, *we can not attain to any scientific knowledge of a time when this principle ought not to hold good;* though it is one of the most amazing things in the whole history of natural science to see how neither Nicholson, nor

Huxley, nor Spencer, nor any of their thousands of followers, have realized how completely this principle removes the whole foundation on which rests the idea of relative time value, which still persists in assuring us that when a Carboniferous group was existing here, a Cambrian group could not have been existing over there, and Cretaceous and Tertiary groups somewhere else. That an assumption of such a supernatural knowledge of the past, totally at variance with our modern knowledge of plant and animal distribution, still flaunts itself in our eyes from every text-book professing to deal with the earth's early history, is an anachronism almost passing belief. Some day, when this science is reconstructed by being built up on inductive principles from the present instead of being postulated from the past, this part of the history of natural science will make a most amazing story for our posterity.

"The Face of the Earth" (Oxford, 1904-1909), by Eduard Suess, of Vienna, is acknowledged by all to indicate the high-water mark in geological literature. In this work several references are made to the problem of what these geological classifications really mean, and finally this author leaves it unsolved, as one of the largest tasks he must bequeath to the next generation of investigators.

Three or four times he alludes to "the remarkable fact that it has been found possible to employ the same terminology to distinguish the sedimentary formations in all parts of the world." (Vol. 2, p. 540.) But it is quite obvious that this is only the

modern aspect of the onion-coat theory in what Spencer calls its "transcendental" form; and it is equally obvious that, if we look upon the geological series of life forms as having no intrinsic time value whatever, but as being only an old-time taxonomic series of that ancient world, as will appear later, this "remarkable fact," which seems such a puzzle to this accomplished scientist, becomes as clear as sunlight, and immediately falls into its natural place in a scheme of true inductive geology.

In his picturesque way Suess puts one of the characteristic features of this modern onion-coat theory in the form of a question, as to how the Silurian formation, one of "the very earliest of them all," "recurs in parts of the earth so widely removed from one another — from Lake Ladoga to the Argentine Andes, and from Arctic America to Australia — always attended by such characteristic features," and how it happens "that particular horizons of various ages may be compared to or distinguished from other horizons over such large areas, that in fact these stratigraphical subdivisions extend over the whole globe." (Vol. 1, p. 8.)

As already remarked, he considers this one of the great unsolved problems of the science, for he says that "if we could assemble in one brilliant tribunal the most famous masters of our science, and could lay this question of the student before them, I doubt whether the reply would be unanimous, I do not even know if it would be definite." (*Id.*)

Of course from the standpoint of current theory

this question must ever remain without explanation; for the one thought pervading this whole work of Professor Suess is that absolutely nothing in the direction of an exchange of ocean and dry land is now going on, and thus we have no modern analogies to explain how those great universal "transgressions" of the ocean took place in the past,— in other words, uniformitarianism is now found to be bankrupt as an explanation of the past geological changes. But how simple this problem becomes, how natural this whole phenomenon appears, when we look upon the geological series as only an old-time taxonomic series of a complete world all living contemporaneously together!

But Professor Suess concludes the discussion of this subject by the very explicit statement that if one were to seek an answer to this problem in "The Face of the Earth," "*he would not find in it an answer to his question.*" (Vol. 1, p. 15.)

It may be worth while to gather into concise form the facts we have learned thus far:

1. The geological ages depend wholly upon the types of life supposed to have flourished at these various periods; and the age of a rock is determined by its contained or associated fossils.

2. Spencer not only saw the absurdity of Werner's onion-coat theory, but he blames Lyell and the other modern geologists for still perpetuating this absurd idea of the geological formations being universal over the globe, and says that we now have

onion-coats of fossiliferous rocks, instead of the old mineral onion-coats of Werner.

3. Huxley acknowledges that geology can prove nothing more than local order of succession; that when we come to deal with large areas, there is "not a shadow of proof" for saying that one type of rock in England was or was not formed at the same time as other rocks in America or Africa; and that all the palæontological notions about the general succession of life on the globe are "not proven and not provable."

4. Nicholson, and indeed all modern geologists, seem quite ashamed of the onion-coat theory of Werner, and they try to prove themselves clear of it by speaking rather timidly of the principle of zoological provinces and districts, partially admitting that dissimilar groups of life must have existed contemporaneously in the olden time as now,— how dissimilar they dare not say, for to admit this principle fully must forever destroy the idea of successive ages of life. For if we renounce entirely this modern form of the onion-coat theory, must we not admit that Mammals may have lived on the land while Trilobites were living in the sea, or that Nummulites may have been contemporary with the Graptolites, or Oaks, Beeches, and Birches contemporary with the Lepidodendrons and Sigillaria? And then what will become of the theory of successive ages?

5. Professor Suess seems dazed at the universal spread not only of the larger groups or formations, but also of the particular horizons or stratigraphical

subdivisions; and he remarks with astonishment that it has been found possible "to employ the same terminology to distinguish the sedimentary formations in all parts of the world." He feels very doubtful, if all the masters of the science were assembled together and this problem were propounded to them, whether the reply would be unanimous, or even "definite." As for himself, he has no explanation.

6. From all this discussion it follows that the geological ages of successive types of life are not scientifically established, and have no scientific value. Hence the Cambrian fossils, for example, can not be proved to be intrinsically older than the Carboniferous, the Cretaceous, or the Tertiary; in short, *no one kind of fossil can be proved to be really older than another, or than the human race.*

On the other hand, what geology has been dealing with all these years under the name of a "phylogenic" series, turns out to be nothing but an old-time taxonomic series, buried somehow, and at some time or times, which must be determined later and by other considerations. But there is absolutely nothing in the geological record to forbid our believing that all these various types of life were created at one time — though how long ago this beginning of life may have been, geological science does not give us the data to determine.

So much, then, for the *a priori* argument. We must now look at the history of the idea, and in subsequent chapters consider the stratigraphical features of the theory.

# CHAPTER II

## History of the Idea

AMONG the few stray principles that the future will probably be able to save from the wreck of Spencer's philosophy, is the advisability of looking into *the genealogy of an idea.* What have been its surroundings? What is its family history? Does it come of good stock, or is its family low and not very respectable?

This is especially true in the case of a scientific idea, which above all others needs to have a clean bill of health and a good family record. But, unfortunately, the idea we are here considering has a bad record, very bad in fact; for the whole Family of Cosmogonies, of which this notion is the only surviving representative, were supposed to have been banished from the land of science long ago, and were all reported dead. Some of them had to be executed by popular ridicule, but most of them died a natural death, the result of inherited taint, in the latter part of the eighteenth and the early nineteenth century. It is perfectly astonishing how any of the family could have survived over into the twentieth century, in the face of such an antecedent record.

For one of the chief traits of the family as a whole is that of mental disorder of various stages

and degrees. Some of them were raving crazy; others were mild and comparatively harmless, except that their drivel had so disturbing an effect on scientific investigations that they had to be put out of the way. It seems such a pity that when this last fellow, early in life, was up before Doctors Huxley, Spencer, and others, for examination, he was not locked up or put in limbo forthwith. This is especially unfortunate, because this survivor of an otherwise extinct race has since then produced a large family, some of which, it is true, have already expired, while the eldest son, Darwinism, was reported in 1901 to be "at its last gasp,"[1] and was even said to have had its "tombstone inscription" written a year or two ago by Von Hartmann of Germany. But the succession-of-life idea itself, the father of all this brood, is still certified by those in authority to be healthy and *compos mentis*.

The Cosmogony Family is a very ancient one, running back to the time of Plato and Thales of Miletus. Indeed, the cuneiform inscriptions of Babylonia seem to indicate that a tribe with very similar characteristics existed several millenniums before the Christian era. But discarding all these, the first men that we need to mention are perhaps Burnet and Whiston, who knew no other way of arriving at geological truth than to spin a yarn about how the world was made. Woodward (1665-1722) seems to have had a little better sense, and is named along

[1] *Nature*, Nov. 28, 1901, pp. 76, 77.

with Hooke and John Ray as one of the real founders of geology.

Unfortunately the brood of Cosmogonists was not dead, for Moro and de Maillet were at this same period spinning their fantastic theories about the origin of things; or as Zittel puts it, "accepted the risks of error, and set about explaining the past and present *from the subjective standpoint.*" ("History of Geology," p. 23.) This tendency we shall find to be a birthmark in the family, and it will serve invariably to identify any of them wherever found. We must remember this, and apply the test to the modern survivors.

Buffon (1707-1788) seems to have been really the founder of the family in the modern form. He is credited with the sarcastic remark that "geologists must feel like the ancient Roman augurs who could not meet each other without laughing;" though in view of his fantastic scheme of seven "epochs," in which he endeavors to portray "the beginning, the past, and the future (*sic*) of our planet,"[2] one is reminded of the common symptom which manifests itself in thinking all the rest of the world crazy.

The "Heroic Age of Geology" succeeded this period, and was characterized largely by a determination to discard speculation, and to seek to build up a true science of actual fact and truth.

We have already seen, from Spencer's remarks, that A. G. Werner (1749-1817), who was, however, one of the leaders in Germany at this time, was

[2] Zittel, p. 42.

very far from following true inductive methods. And the following language of Sir Archibald Geikie shows that in him the family characteristics were decidedly prominent:

> But never in the history of science did a stranger hallucination arise than that of Werner and his school, when they supposed themselves to discard theory and build on a foundation of accurately ascertained fact. Never was a system devised in which theory was more rampant; theory, too, unsupported by observation, and, as we now know, utterly erroneous. From beginning to end of Werner's method and its applications, assumptions were made for which there was no ground, and these assumptions were treated as demonstrable facts. *The very point to be proved was taken for granted,* and the geognosts, who boasted of their avoidance of speculation, were in reality among the most hopelessly speculative of all the generations that had tried to solve the problem of the theory of the earth.—*"Founders of Geology," p. 112; Johns Hopkins Press, 1901.*

In fact this author says that "the Wernerians were as certain of the origin and sequence of the rocks as if they had been present at the formation of the earth's crust." (Pp. 288, 289.)

Here we see the family characteristics very strongly developed.

In speaking of Werner's five successive "suites" or onion-coats in which he wrapped his embryo world, Zittel complains:

> Unfortunately, Werner's field observations were *limited to a small district,* the Erz Mountains and the neighboring parts of Saxony and Bohemia. And his chronological scheme of formations was founded upon the mode of occurrence of the rocks within these narrow confines.—*P. 59.*

And yet, as we have seen, it is precisely such a charge as this that Spencer and Huxley bring against the modern phase of the doctrine of successive ages based on the succession-of-life idea. Werner, from observations "limited to a small district," constructed his scheme of exact chronological sequence for the rest of the world, basing it entirely upon the mineral or mechanical character of his "suites." And hundreds of enthusiastic followers long declared that the rocks everywhere conformed to this classification, even so great an observer as Von Humboldt thinking that the rocks which he examined in Central and South America fully confirmed Werner's chronological arrangement.

But such notions to-day only cause a smile of pity, for it is now well known that, take the world over, the rocks do not occur as Werner imagined, though, as Geikie says, he and his disciples were as certain of the matter "as if they had been present at the formation of the earth's crust." Besides, as already pointed out, we moderns ought now to have pretty well assimilated the idea that while one kind of mineral or rock was forming in one locality, *a totally different kind of deposit* may have been in process of formation in another spot some distance off *at the very same time,* and we can not imagine a time in the past when this principle would not hold good. But in a precisely similar way the idea of a time value was, as we shall see, transferred from the mechanical and mineral character of the rocks to their fossil contents; and from observations again

"limited to a small district," William Smith and Cuvier conceived the idea that the fossils occurred *only* in a certain order; that only certain fossils lived at a certain time; that, for example, while Trilobites were living and dying in one locality, Nummulites or Mammals positively were *not* living and dying in another locality, though in any system of clear thinking this latter notion is just as irrational as that of Werner.

In short, this new system of identifying rocks by their fossils still retained the whole essential absurdity of the onion-coat theory, namely, the *universality* of one kind of deposit; it merely restated this theory in terms of the fossils, instead of in terms of mineralogy and mechanical texture. It involved all the arbitrary assumptions, all the incredible fictions about unnatural past conditions, which characterized the theory of Werner which it professed to displace; and though all modern scientists profess to have outgrown these crudities, they have never made a clean job of eliminating the characteristic absurdity of the whole system, namely, *the universality, in the long ago, of one limited assemblage of life forms.* Hence Spencer is compelled to say, "Though the onion-coat hypothesis is dead, its spirit is traceable, under a transcendental form, even in the conclusions of its antagonists."

The two cases are exactly parallel; only it has taken us nearly a hundred years, it seems, to find out that the fossils do not follow the prearranged order of Smith and Cuvier any better than the rocks

and minerals follow the scheme of Werner. If hundreds of geologists still seem to think that the fossils in general agree with the standard order, we must remember how many sharp-eyed observers said the same thing for decades about Werner's scheme. The taint of heredity will always come out sooner or later; and both of these schemes exhibit very strongly the family history of the whole tribe of Cosmogonies, for *the facts refuse to certify that they are of sound mind.*

It was William Smith (1769-1839), an ignorant English land surveyor, who first conceived the idea of fixing the relative ages of strata by their fossils. Just how far he carried this idea it seems difficult to determine exactly. Lyell[3] says nothing along this line about him, save that he followed the leading divisions of the Secondary strata as outlined by Werner, though he claims "independently" of the latter. Whewell[4] remarks rather pityingly on his having had "no literary cultivation" in his youth, but has nothing about the degree in which he is responsible for the modern scheme of life succession of which many modern geologists have made him the "father." Geikie and Zittel are much more explicit. The former[5] says that "he had reached early in life the conclusions on which his fame rests, and he never advanced beyond them." "His plain, solid, matter-of-fact intellect never branched into

[3] "Principles," p. 50, 8th ed.

[4] "History of the Inductive Sciences," Vol. 2, p. 521.

[5] "Founders of Geology," pp. 237, 238.

theory or speculation, but occupied itself wholly in the observation of facts." Zittel[6] says pretty much the same thing, remarking that "Smith confined himself to the empirical investigation of his country, and was never tempted into general speculations about the history of the formation of the earth"— words which to my mind are the very highest praise, for they seem to indicate that he was only in a very limited way responsible for the unscientific and illogical scheme of a "phylogenic series" or complete "life history of the earth," which now passes as the science of geology. Doubtless, like his little bright-eyed German contemporary, A. G. Werner, he had not had his imagination sufficiently cultivated in his youth to be able to appreciate the beauty of first assuming your premises and then proving them by means of your conclusion; that is, first assuming that there has been a gradual development on the earth from the lowest to the highest, and then arranging the fossils from scattered localities over the earth in such a way that they can not fail to testify to the fact.

The following may be taken as a fair statement of what he actually accomplished and taught:

> After his long period of field observations, William Smith came to the conclusion that one and the same succession of strata stretched through England from the south coast to the east, and that each individual horizon could be recognized by its particular fossils, that certain forms reappear in the same beds in the different localities, and that

[6] "History," p. 112.

each fossil species belongs to a definite horizon of rock.'[7] — *Zittel, "History," p. 112.*

But even granting the perfect accuracy of this generalization of Smith's for the rocks which he examined, I fail to see how it is any better than Werner's scheme, which Zittel characterizes as "weak" and premature, and of which Whewell (p. 521) says that "he promulgated, as respecting the world, a scheme collected from a province, and even too hastily gathered from that narrow field."

Quoting again from Zittel's criticism of Werner's work ("History of Geology," p. 59), we must admit that Smith's observations also were "limited to a small district," and "his chronological scheme of formations was founded upon the mode of occurrence of the rocks [fossils] within these narrow confines." There is, as we have shown, a monstrous jump from this to the conclusion that even these particular fossils must always occur in this particular relative order over the whole earth. How can any one deny that if we had a complete collection of *all* the fossils laid down during the last thousand years — when all admit that the so-called "phylogenic series" is complete — *particular fossils would in many cases be found to occur only in particular rocks*,[8] and often be associated with only

[7] It should be noted that all these rocks in England thus examined by Smith make up only a small fraction of the total geological series — largely what we now call the Jurassic and Cretaceous rocks.

[8] "The plants and animals of different geological periods do not differ more from one another than those in opposite climates, or even distant localities, at present."— *Phillips, "Manual of Geology," p. 628, 1855.*

certain kinds of minerals, such as clay, limestone, or sand, and we could still arrange them in this same artificial order from the lowest to the highest forms of life, while we might even find "small districts" where the "mode of occurrence of the rocks within these narrow confines" would happen to have all the appearance of showing a true "phylogenic" or taxonomic order? At any rate, every one knows that when we find, let us say, one plant belonging to the Heath family, we are very likely to find a dozen or two dozen species of this same family in the immediate vicinity; and the same is true of thousands of other groups. All of which only means that even in our modern world groups of related species are often segregated off together, and occur in particular localities only; while the same or similarly associated groups of species may recur here and there in localities widely separated from each other. These things ought to be sufficient to show us the weakness of this subjective method of study, and the purely hypothetical and artificial value of the fossils in determining the real age of a rock deposit; because the geological classifications really represent taxonomic values, the "phylogenic series" is nothing more than an old-time taxonomic series, and there is absolutely nothing at all to prove that it represents succession in time.

The name of Baron Cuvier (1769-1832) is the next that we have to consider. An examination of part of his teaching will come naturally a little later when considering "extinct species." That part of

his work which related to the doctrine of catastrophism is somewhat aside from the subject of our study; while with regard to his influence on the succession-of-life idea *per se* there is not very much that need be said. And yet Cuvier is the real founder of modern cosmological geology, and thus in a certain sense the father of biological evolution.

But if the absence of the architectonic mania for building a cosmogony will serve to remove in a great measure any suspicions with regard to William Smith's results, we can not say the same for those of Cuvier. In his scheme the hereditary cosmological taint, which is such an invariable characteristic of the family, is very strong, though disguised and almost transfigured by learning and genius. Doubtless these latter qualities have secured for the theory its phenomenal length of life, though of course we know that nothing born of this whole brood of subjective speculations can ever secure a permanent home in the kingdom of science.

"How glorious," wrote this otherwise truly great man, in his famous "Preliminary Discourse," "it would be if we could arrange the organized products of the universe in their chronological order, as we can already [Werner's onion-coats] do with the more important mineral substances!"

His work (with that of his colaborer Brongniart) on the fossils of the Paris basin was probably accurate and logical enough for that limited locality. It was only when he quietly assumed, as Werner had done, that the rocks must always occur in this par-

ticular order all over the world, or as Whewell expresses it, "promulgated as respecting the world, a scheme collected from a province, and [perhaps] even too hastily gathered from that narrow field"—it was only, I say, when this monstrous assumption was incorporated into his scheme, and he began to call into being his "glorious" vision of organic creation on the instalment plan, as Werner had done with the minerals, that his great and valuable work for science became tainted with the deadly cosmological virus, dooming it to death sooner or later. Sherlock Holmes might attempt to diagnose a disease by a mere glance at his patient's boots, but even this gave him more pertinent data and was a more logical proceeding than the facts and methods of Cuvier supplied for constructing a scheme of organic creation.

It will not be necessary to detail the manner in which the modern "phylogenic series" was gradually pieced together from the scattered fragments here and there all over the globe; but it should be noted here that the whole chain of life was practically complete before any serious attempt was made to study the rocks on the top of the ground, and to find out how this marvelous record of the past *joined on to the modern period,* thus reversing completely the true scientific method, and leaving the most important of all, that is, the rocks containing human remains and other *living* species, over till the last, with the result that we have for over half a century been laboring under a "glacial nightmare," and these

deposits on the top of the ground "still remain in many respects the despair of geology."

In the meantime many attempts had been made to teach a theory of descent or evolution. Erasmus Darwin, the grandfather of Charles Darwin, published a book in 1796 advocating this idea; while Lamarck in 1809, and others soon after, tried to embellish this and make it plausible with all the scientific knowledge then obtainable. Lamarck's theory was based on spontaneous generation, and on the alleged power to transmit to posterity the characters acquired during the lifetime of the parent, particularly the characters acquired as the effects of use and disuse.

To all these evolutionary theories the commanding genius and scientific renown of Cuvier were in direct opposition. By the year 1830 the conflict had become acute; and by Cuvier's victory that year over Geoffroy Saint-Hilaire, the theory of successive distinct creations remained the only thing recognized as science. Indeed, from this date onward for several decades, the theory of evolution "sank into oblivion," to use the words of August Weismann, "and was expunged from the pages of science so completely that it seemed as if it were forever buried beyond hope of resurrection." (Smithsonian Report, 1909, p. 433.)

In further description of the evolutionary theories as then presented we have the following:

> All sorts of vague speculations were indulged in; and these contributed less and less to the support of the

theory, the more far-reaching they became. Many champions of the "Naturphilosophie" of the time, especially Oken and Schelling, promulgated mere hypotheses as truths; forsaking the realm of fact almost entirely, they attempted to construct the whole world with a free hand, so to speak, and lost themselves more and more in worthless phantasy. This naturally brought the theory of evolution, and with it "Naturphilosophie," into disrepute, especially with the true naturalists, those who patiently observe and collect new facts. The theory lost all credence, and sank so low in the general estimation that it came to be regarded as hardly fitting for a naturalist to occupy himself with philosophical conceptions.— *August Weismann, Smithsonian Report, 1909, p. 432.*

But in the meantime a more detailed knowledge of rocks, plants, and animals was gathered; and with the doctrine of Creation represented only in burlesque by the successive ages of Cuvier, it was inevitable that the seeming victory of the latter could be only short-lived, so that the following years were marked by the rise of the modern view of geology and biological evolution, under Lyell (1797-1875), Agassiz, and Darwin, a feature of the history that is too familiar to need repetition here. But it must be noted in passing that, as the results of the keen discussions regarding the transmission of acquired characters, which were started by Weismann in the latter eighties of the last century, the modern world has about settled two of the chief points involved; namely:

1. That so far from natural selection being able to originate a new species, it can not really originate anything at all, or as Hugo de Vries remarks, "It may explain the survival of the fittest, but it

can not explain the arrival of the fittest" ("Species and Varieties," pp. 825, 826); and —

2. That changes in the individual induced by environment or by use and disuse of organs are not transmitted to offspring, as has been abundantly shown by Weismann, Wallace, Lankester, and others.

And hence it is hard to see what there is left of what is generally known as Darwinism.

Of course there are abundant proofs that such so-called "species" as the Yak and Zebu of India, the Bison of America, and the common domestic Cattle, have all come from a common stock, since it is well known that they will breed freely together. The same thing may be said of the twenty-odd species of Pigs scattered over the Old World ("Mammals Living and Extinct," pp. 284, 285), or of the numerous species of Dogs, Wolves, Foxes, Hyænas, etc. Hence there is a sense in which these discussions about the origin of species have resulted in an enlargement of our permanent stock of knowledge regarding living forms.* On the other hand, it now

* To show that the author is not adopting any new or strange view of the question of what constitutes a species, some quotations may not be amiss. The Standard Dictionary says that the term is used for "a classificatory group of animals or plants subordinate to a genus, and having members that differ among themselves only in minor details of proportion and color, and are capable of fertile interbreeding indefinitely." Le Conte also says: "There are two bases on which species may be founded. Species may be based on form, morphological species; or they may be based on reproductive functions, physiological species. By the one method a certain amount of difference of form, structure, and habit constitute species; according to the other, if the two kinds breed freely with each other, and the offspring is indefinitely fertile, the kinds are called varieties; but if they do not, they are called species." And he adds that this latter test "is regarded as a most important test of true species, as contrasted with varieties or races." ("Evolution and Religious Thought," p. 233.)

seems extremely doubtful if either of the above supposed factors, natural selection or the transmission of acquired characters, has been chiefly concerned in bringing about the diversity that now exists among our animals and plants, even where this diversity can reasonably be supposed to have originated since the original Creation. In short, the whole biological field seems about worked out all around, so far as this problem is concerned; and the net results appear to be that, while there is variation in plenty among the plants and animals about us, far more and greater variation than was formerly supposed, yet life seems to be walled in by certain impassable limits beyond which it has never yet been found possible to carry the results of any artificial or natural change; while the theory of spontaneous generation is dead for all coming time.

We have not the space to show in detail how Agassiz (1807-1873) further complicated the problem immensely by an absurdly illogical use of his three "laws" of comparison between the embryonic development of the modern individual and the phylogenic series manufactured to fit it, when the prime fact of there ever having been a succession of life on the globe in any order whatever had never been proved objectively; but I am free to say that if Cuvier's system of creation on the instalment plan had been fact instead of fancy, some method of evolution would undoubtedly be implied in this general fact. It is this instinctive feeling on the part of modern scientists which makes them to-day, while

confessing the failure of Darwinism, still cling to the general idea of evolution somehow. Hence it seems quite evident that, having deviated from strict inductive methods by pursuing this *ignis fatuus* of a cosmological history of Creation, it was essential in the interests of true science to go the whole journey, even though it was leading up a blind alley, and make a complete investigation of both the biological and the geological side of the question, in order to complete the demonstration that science was on a wrong track entirely, and that Creation was not brought about in any such way. Darwin and Weismann were inevitable in view of the wholly unscientific course on which biology entered under the guidance of Buffon and Cuvier; and Howorth and Suess were as inevitable in demonstrating the folly of trying to explain the past geological changes by the uniformitarianism of Hutton and Lyell. Uniformity and evolution have had a fair chance, an open field, and have done their best. But they have failed, miserably failed.

What, then, can we take as the general lesson to be learned from the stubborn way in which, for over a hundred years, the world has followed this hypnotic suggestion of folly that we might explain the origin of our world from the scientific standpoint as only just like things that are now going on? One of the lessons — there may be others — is that science knows nothing about the details or order of Creation, for these are wholly beyond its sphere; and that, in speculating along these lines, the cosmological taint

will always vitiate the accuracy of our conclusions and debauch the true spirit of induction. A hundred years ago, some leaders of natural science thought they knew all about how the world was made. Wholly immune from doubt, they thought they had discovered what they had only invented — a mere shadow of their minds' own throwing. The keen investigations inspired by Darwinism and Lyellism were necessary to convince us that in a scientific way we know nothing at all about it. Modern science has simply developed a gigantic negative demonstration that it did *not* occur by a gradual and long-drawn-out progression from the low to the high, and by processes similar to what is now going on; and the evolution doctrine is only a by-product in this demonstration. A hundred years — nay, fifty years — ago this assumption did not appear so unscientific, for we did not then have the biological and the geological evidence to refute such an idea. Now, however, in the light of the modern progress of science, this awful mystery of our existence, of our creation and destiny, is borne in upon us from every dividing cell, from every sprouting seed, from countless millions of the eloquent voices of nature, which our forefathers were too blind to see, too deaf to understand; and with weary, reluctant sadness does human science confess that about it all she knows absolutely nothing.

It is important to make this point clear, for it is the very quintessence of modern science, the net results of all our investigations. What we have

observed, what we know, is science (Latin, *scio*, I know). But when all our investigations only impress us the more deeply with the conviction that we do not know anything and can never hope to know anything in a scientific way of *how* the world was made, or how life, or the species of animals and plants, came into existence, the conclusion is inevitable that *Creation was something different, essentially and radically different, from what is now going on.* The central idea of the evolution doctrine is *uniformity*, that is, that what is now going on is identical with or similar to what has always been going on; that the present operations of nature are as much a part of creation as anything that ever took place in the past. But the net results of modern science are against all this. They assure us, with words that are all the more convincing because they have been forced from unwilling lips, that there must have been a real, immediate Creation at the beginning, essentially different from anything now taking place. The opening words of the Christian's Bible are at last being vindicated by modern science: "In the beginning God created the heaven and the earth."

# CHAPTER III

## Fact Number One

HITHERTO we have been dealing only with the *a priori* aspects of the succession-of-life idea. We have seen that it is really based on two primary assumptions; namely:

1. That in the long ago there were no zoological provinces and districts, and totally different types could not have been living contemporaneously in widely separated localities,— which is only the modern form of the onion-coat theory stated negatively; and also —

2. That over all the earth the fossils must always be found occurring in the particular order in which they were first found in a few corners of Western Europe.

We have dealt with only the first of these assumptions in the first chapter of this book. The whole idea is confessedly intricate, and very few even among geologists have done enough persistent, calm thinking on the subject to get any clear ideas regarding it. Most of them profess to discard the old onion-coat theory, and claim to believe in zoological provinces and districts in the olden time. But it is obvious that if the latter notion is honestly and persistently adopted, we can not put any limits to

# GEOLOGICAL CLASSIFICATIONS
## As Usually Arranged

| GROUP OR SYSTEM | DIVISION | CLASS | DOMINANT TYPE |
|---|---|---|---|
| Cenozoic | Quaternary or Post-Tertiary or Pleistocene | Recent or Terrace<br>Champlain<br>Glacial | Man |
| | Tertiary | Pliocene<br>Miocene<br>Eocene | Mammals |
| Mesozoic | Cretaceous | Upper Cretaceous<br>Lower Cretaceous | Reptiles<br>Conifers<br>and Palms |
| | Jurassic | Oolitic<br>Liassic | |
| | Triassic | Upper<br>Middle<br>Lower | |
| Palæozoic | Carboniferous | Permian<br>Coal-measures<br>Subcarboniferous | Amphibians<br>and<br>Coal Plants |
| | Devonian | Upper Devonian<br>Middle Devonian<br>or Hamilton<br>Corniferous<br>Oriskany | Fishes and<br>Insects |
| | Upper Silurian | Lower Helderberg<br>Onondaga<br>Niagara | Invertebrates |
| | Lower Silurian | Trenton<br>Canadian | |
| | Cambrian | Upper<br>Middle<br>Lower | |
| | Pre-Cambrian, or Algonkian | | |
| Primitive | Archæan | | (No Fossils) |

the diversity of plants and animals that may have coexisted in widely separated localities; that is, Mammals may have been living on the land while Trilobites were living in the sea; or the Nummulites may have been contemporary with the Graptolites; or Oaks, Elms, and Beeches, contemporary with the Lepidodendrons and Sigillaria. But since the current theories indignantly deny these latter possibilities, it is only in effect to deny the existence, in the ancient time, of zoological provinces and districts, and to adopt the biological form of the onion-coat theory. These are the two horns of the dilemma.

But it is self-evident that the *second* of the above assumptions must *also* be involved in the life succession idea. It is on the blending of these two assumptions, the former essentially absurd, and the latter long ago disproved by the facts of the rocks, that there has been built up the complete "phylogenic series" from the Cambrian to the Pleistocene. For it is obvious that not merely one, but *both* of these points must be true in order to establish the geological life succession. But since *both are false,* the whole theory of successive ages is left without any defense in logical or scientific reasoning.

The way in which, as we have seen, Spencer, Huxley, and others treated this subject, reminds us very much of the old advice, "When you meet with an insuperable difficulty, look it steadfastly in the face — and pass on." For neither they nor any of their thousands of followers have ever, so far as I know, pointed out the horrible logic in taking this

immense complex of guesses and assumptions as the starting-point for new departures, the solid foundation for detailed "investigations" as to *just how* this wonderful phenomenon of development has occurred. For after Agassiz and his contemporaries had built on these large assumptions of Cuvier, and had arranged the details and the exact order of these successive forms by comparison with the embryonic life of the modern individual, the evolutionists of our time, led by such men as Spencer and Haeckel, with their "biogenetic principle," *prove* (?) their theory of evolution by the assertion that the embryonic life of the individual is only "a brief recapitulation, as it were from memory," of this (artificial) geological succession. There would really seem to be little hope of reaching with any arguments a generation of scientists who can elaborate genealogical trees of descent for the different families and genera of the animal kingdom, based wholly on such a series of assumptions and blind guesses, and then palm off their work on a credulous world as the proved results of *inductive* science.

And yet I am tempted to make some effort in this direction. I suppose I must not blame my scientific colleagues, any more than I blame myself. Fifty years ago, nay, twenty-five years ago, we did not have the facts which are now at hand. But since we have quite fully examined the various aspects of the *a priori* argument under the head of the onion-coat theory, it simply remains to test the second of the above-mentioned assumptions by the facts of the

rocks; because the first of these assumptions, or even any phase of the onion-coat theory, is quite evidently beyond the pale of sober scientific discussion. For if any one has so far forsaken the paths of inductive science as to dogmatize about a time in the past when there were no zoological provinces and districts, but only one and the same assemblage of life forms everywhere on earth, there is no use attempting to reason with him until he gets back on solid ground once more. Hence it remains now simply to test by the facts of the rocks *the second assumption; namely, that all over the earth the fossils invariably occur in the particular order in which they were first found in a few corners of Western Europe* by the founders of the science. Have we already a sufficiently broad knowledge of the rocks of the world to decide such a question? I think we have.

To begin, then, at the beginning, let us try to find out how we can fix on the rocks which are undeniably the oldest on the globe. We should expect to find a good many patches of them here and there, but there must be some common characteristic by which they may be distinguished wherever found. Of course, when I say "rocks" here I mean fossils; for as has long been agreed upon by geologists, mineral and mechanical characters are of practically no use in determining the age of deposits, and we are here dealing only with life and the order in which it has occurred on the globe. Accordingly our problem is really to find that typical group of fossils

which is essentially older than all dissimilar groups of fossils.

In most localities we do not have to go very far down[1] into the earth to find granite or other so-called igneous rocks, which not only do not contain any traces of fossils, but which we have no proper reason for supposing ever contained any. These Azoic or Archæan rocks constitute practically all the earth's crust, there being only a thin skim of fossiliferous strata on the outside, like the skin on an apple. Now it would be natural enough to suppose that those fossils which occur at the bottom, or *next to the Archæan,* are the oldest. This is doubtless what the earlier geologists had in mind, or at least ought to have had, though it is not quite certain that they had any clear thoughts on the matter whatever. They did not really begin at the bottom, but half way up, so to speak, at the Mesozoic and Tertiary rocks; and Sedgwick and Murchison, who undertook to find bottom, became too excited over their Cambro-Silurian controversy to attend to so insignificant a detail as the logical proof that any type of fossil was really older than all others. If they had really stopped to consider that some type of fossil might occur next to the Archæan in Wales, and another type occur thus in Scotland, while still another type altogether might be found in this position in some other locality, and so on over the world, leading us

[1] When the text-books speak of ten or twelve miles thickness of the fossiliferous rocks, the reader should remember how the rocks have to be patched up together from here and there to make this incredible thickness, as only a small fraction of such a thickness exists in any one place.

to the very natural conclusion that in the olden times as now *there were zoological provinces and districts,* the history of science during the nineteenth century might have been very different, and this chapter might never have been written. But this commonplace of modern geology, that any type of fossil whatever, even the very "youngest," may occur next to the Archæan, was not then considered or understood; and when about 1830 it came to be recognized, other things were allowed to obscure its significance, and the habit of arranging the rocks in chronological order according to their fossils was too firmly established to be disturbed by such an idea.

It was long thought that the "Olenellus" beds were the oldest fossiliferous deposits. They were first described from Scandinavia, but have since been found in Newfoundland, the Rocky Mountains, and elsewhere. Of late years, however, other rocks have been distinguished in these same regions as still older, and have been called Pre-Cambrian, Algonkian, and various other names that all refer to the same deposits. They consist of conglomerates, sandstones, graywackes, quartzites, slates, and limestones, and contain traces of Protozoa, Cœlenterates, Echinoderms, Brachiopods, Mollusks, Worms, and Arthropods, though these fossils are extremely scarce and not very well preserved. The reasons for calling these rocks older than any Cambrian beds are too technical to be given here in detail, but the argument consists essentially of two points: (1) They are sometimes found stratigraphically below beds classed

as Lower Cambrian, and (2) They contain, in the aggregate, fossils of a more "generalized" structure than those of the Cambrian. Accordingly these Algonkian or Pre-Cambrian beds are regarded as the oldest fossiliferous deposits on the globe.

Now, granting these two facts as stated, where are we in point of strict logic and demonstrable science? Quite obviously we are just where we started in the first chapter of this book. For shall we say (1) that when these Pre-Cambrian forms were living in these localities, there could have been no other distinctly different forms of life living elsewhere? Or shall we boldly and baldly assume (2) that at one time these beds were actually universal around the globe, like Werner's onion-coats? There is no third choice. But to hold openly to either of these alternatives is surely not a very comfortable position for any one to be placed in who wishes to pass as a scientist. In no other department of modern thought could such postulates be seriously considered for a minute, and the time must soon come when they will be considered as anachronisms even in geology. On the other hand, how are we to know in a scientific way that the lowest or more "generalized" forms must actually have lived before others? Is such a postulate sufficiently axiomatic to serve as a foundation-stone for not only geology but all biological science? Surely there is no need of pointing out that such a premise begs the whole question of evolution. What is the use of any further discussion, if we already know that the lowest or more

generalized types of life lived first and the other higher or more specialized forms came afterward?

Thus we are restricted to the one sensible and really scientific fact regarding these beds; namely, their stratigraphical position. For any given limited locality, where stratigraphy can be followed out, the lowest beds are of course the oldest. But we can make no progress by such a method when we come to deal with the world at large, for actual stratigraphical relationships can be proved over only very limited areas. These beds may be the lowest in this locality, may rest on the granite, and have every appearance of antiquity. But other beds, containing very different fossils, are in precisely this position elsewhere, and where stratigraphical position can no more prove relative age than the overlap of scales on a fish proves those at the tail to be older than those at the head.

For the Fact Number One, which I have chosen as the subject of this chapter, is the now well-established principle that *any kind of fossiliferous rock whatever, even "young" Tertiary rocks, may rest upon the Archæan or Azoic series, or may themselves be almost wholly metamorphosed or crystalline, thus resembling in position and outward appearance the so-called "oldest" rocks.*

The first part of this proposition, about any rocks occurring next to the Archæan, is covered by the following quotation from Dana:

A stratum of one era may rest upon any stratum in the whole of the series below it,— the Coal-measures on either the

Archæan, Silurian, or Devonian strata; and the Jurassic, Cretaceous, or Tertiary on any one of the earlier rocks, the intermediate being wanting. The Quaternary in America in some cases rests on Archæan rocks, in others on Silurian or Devonian, in others on Cretaceous or Tertiary.—*"Manual," p. 399, 4th ed.*

It would be tedious to multiply testimony on a point so generally understood.

As for the other half of this fact, that even the so-called "youngest" rocks may be metamorphic and crystalline just as well as the "oldest," it also is now a recognized commonplace of science. Dana[2] says that as early as 1833 Lyell taught this as a general truth applicable to "all the formations, from the earliest to the latest."

But the converse of this Fact Number One is equally true; that is, the very oldest rocks may not only be on the surface, but may be still unconsolidated, the Cambrian rocks occurring thus around the Baltic and in various parts of the United States, where "the rocks still retain their original horizontality of deposition, the muds are scarcely indurated, and the sands are still incoherent." ("Encyclopædia Britannica," Vol. 5, p. 86, Cambridge University ed.)

The first reference I can find to any disproof of this old fable of Werner's, that only certain kinds of rock are to be found next to the "Primitive" or Archæan, is in the observations of Studer and Beaumont in the Alps (1826-1828), who found "relatively young" fossils in crystalline schists, which, as Zittel says, "was a very great blow to the geologists who

[2] "Manual," p. 408.

upheld the hypothesis of the Archæan or Pre-Cambrian age of all gneisses and schists."

James Geikie, doubtless referring to the same series of rocks, tells us that "in the Central Alps of Switzerland, some of the Eocene strata are so highly metamorphosed that they closely resemble some of the most ancient deposits of the globe, consisting, as they do, of crystalline rocks, marble, quartz rock, mica schist, and gneiss." ("Manual of Historical Geology," p. 74.)

Hence we need not be surprised at the following statement of the situation by Zittel:

> The last fifteen years of the nineteenth century witnessed very great advances in our knowledge of rock deformation and metamorphism. *It has been found that there is no geological epoch whose sedimentary deposits have been wholly safeguarded from metamorphic changes;* and as this broad fact has come to be realized, it has proved most unsettling, and has necessitated a revision of the stratigraphy of many districts in the light of the new possibilities. The newer researches scarcely recognize any theory; they are directed rather to the empirical method of obtaining all possible information regarding microscopic and field evidences of the passage from metamorphic to igneous rocks, and from metamorphic to sedimentary rocks.—*"History," p. 360.*

But in addition to what Zittel means by recognizing "no theory" as to the origin of the various sorts of igneous rocks, it seems to me that this "broad fact" ought surely to prove "most unsettling" to the traditional theories about certain fossils being intrinsically older than others. With our minds divested of all prejudice, and this "broad" Fact Number One well comprehended, that any kind

of fossil whatever may occur next to the Archæan, and the rocky strata containing it may in texture and appearance "closely resemble some of the most ancient deposits on the globe," *where* on this broad earth shall we look for the place *to start* our life succession? That is, where can we now go to find those kinds of fossils which we can prove, by independent arguments, to be undeniably older than all others? Or how are we to be sure that when the so-called "oldest" types, let us say the Algonkian or Pre-Cambrian, were in existence, this assemblage of life alone encircled the globe, and no other very diverse type was in existence anywhere on earth? It may seem very difficult for some of us to discard a theory so long an integral part of all geology; but until it can be proved that this "broad fact" as stated by Zittel and Dana is no fact at all, I see no escape from the acknowledgment that *the doctrine of any particular fossils being essentially older than others is a pure invention, with absolutely nothing in nature to support it.*

Or, to state the matter in another way, Since the life succession theory rests logically and historically on the biological form of Werner's onion-coat notion that only certain kinds of rocks (fossils) are to be found at the "bottom," or next to the Archæan, and it is now acknowledged everywhere that any kind of rocks whatever may be thus situated, it is as clear as sunlight that the life succession theory rests logically and historically on a myth, and that there is *no way of proving what kind of fossil was buried first.*

Of course, the reason the followers of Cuvier and his life succession now find themselves in such a predicament as this, is because they have not been following true inductive methods. Theirs has been a geology by hypothesis instead of by observed fact. They started out with a pretty scheme ready made about the origin and formation of the world, perfectly innocent of any evil intent in such a method of procedure, and unconscious of its speculative or subjective character; and for nearly a hundred years they have supposed that they were following inductive methods in geology. But in view of what we have now learned, I think we are perfectly justified in adapting and applying to Cuvier and the modern school of geologists what Geikie says about Werner and his school:

> But never in the history of science did a stranger hallucination arise than that of Cuvier and the modern school, when they supposed themselves to discard theory and build on a foundation of accurately ascertained fact. Never was a system devised in which theory was more rampant; theory, too, unsupported by observation, and, as we now know, utterly erroneous. From beginning to end of Cuvier's method and its applications, assumptions were made for which there was no ground, and these assumptions were treated as demonstrable facts. The very point to be proved was taken for granted, and the evolutionary geologists who boasted of their avoidance of speculation, were in reality among the most hopelessly speculative of all the generations that had tried to solve the problem of the theory of the earth.—*"Founders of Geology," p. 112.*

# CHAPTER IV

## Fact Number Two

If we had ample evidence that a certain man was personally acquainted with Julius Cæsar, that they were born in the same town, went to school together, served in the same wars, and later carried on an extensive mutual correspondence, would we not conclude that they must have lived in the same *age* of the world's history? I confess that the conclusion seems quite unavoidable. Who would dream that nineteen centuries or so had separated the two lives, and that while one was an old Roman the other was an American of the twentieth century?

Some such a puzzle as this is presented in geology under the general subject of *conformability.* Let me define this term.

Strata laid down by water are in the first place in a horizontal position. Some subsequent force may have disturbed them, so that we may now find them standing up on edge like books in a library. But all human experience goes to show that they were not deposited in this position. Some disturbing cause must have taken hold of them since they were laid down, for the water in which they were made must have spread them out smooth and horizontal, each subsequent layer or stratum fitting "like a

glove" on the preceding. Thus when we find two successive layers agreeing with one another in their planes of bedding, with every indication that the lower one was not disturbed in any way before the upper one was spread out upon it, the two are said to be *conformable.* But if the lower bed has evidently been upturned or disturbed before the other was laid down, or if its surface has even been partly eroded or washed away by the water, the strata are said to be *unconformable,* or they show *unconformability* in bedding.

Of course, in all this we are dealing only with *relative* time. When we find one bed or stratum lying above another in their natural position, the lower one is of course the older of the two; but whether laid down ten minutes earlier, or ten million years earlier, how are we to determine? Ignoring the matter of the fossils they contain, must we not own that, though there is no way of telling just how long the lower one was deposited before the next succeeding, yet if the two are *conformable* to one another, and the bottom one shows no evidence of disturbance or erosion before the other was fitted upon it, the strong presumption would seem to be that *no great length of time* could have elapsed between the laying down of the two layers? To say that we have here a geological example similar to that of a modern American having been personally acquainted with Julius Cæsar, would seem to be quite "inexplicable," to use Herbert Spencer's favorite word.

But if the life succession theory be true, we have just such a conundrum in our Fact Number Two, which is that *any formation whatever may rest conformably upon any other "older" fossiliferous formation.*[1]

The lower may be Devonian, Silurian, or Cambrian, and the upper one Cretaceous or Tertiary, and thus, according to the theory, millions on millions of years must have elapsed after the first, and before the following bed was laid down, but the conformability is perfect, and the beds have all the appearance of having followed in quick succession. Sometimes, too, these age-separated formations are lithologically the same, and can only be separated by their fossils! A still more amazing fact, from the standpoint of current theory, is that these conformable conditions are often *repeated over and over again in the same vertical section,* the same kind of bed reappearing alternately with other beds of an entirely different character; that is, a certain kind of fossiliferous stratum may be found *interbedded several times* in a manifestly undisturbed series of very different beds. Of course these things are a great puzzle to the believers in the successive ages, while they are perfectly intelligible to the advocates of inductive geology.

But before going into the minute description of

[1] Over three quarters of a century ago this principle was recognized. "I feel persuaded that there is no fact more clear in geology than this; namely, that the upper surface of almost every formation was yet soft and moist when the superincumbent sediments were deposited upon it." (Fairholme, "The Mosaic Deluge," p. 396, 1837.)

any of these cases, we must notice some general statements. Thus as long ago as the date of the publication of "The Origin of Species," Darwin, in speaking of the "imperfection of the geological record," could speak of "the many cases on record of a formation *conformably covered,* after an immense interval of time, by another and later formation, without the underlying bed having suffered in the interval by any wear and tear." ("Origin," Vol. 2, p. 58, 6th ed. The first edition, I believe, contains the same language.)

Also Geikie, in speaking of how "fossil evidence may be made to prove the existence of gaps which are not otherwise apparent," says that "it is not so easy to give a satisfactory account of those which occur where the strata are strictly conformable, and where no evidence can be observed of any considerable change of physical conditions at the time of deposit. A group of *quite conformable strata having the same general lithological characters throughout,* may be marked by a great discrepance between the fossils of the upper and the lower part." In many cases, he says, these conditions are "*not merely local,* but persistent over wide areas. . . . They *occur abundantly* among the European Palæozoic and Secondary rocks," and are "traceable over wide regions." ("Text-Book," p. 842.)

We have seen how Dana admits that "a stratum of one era may rest upon any stratum in the whole series below it, . . . the intermediate being wanting." He classes this under the head of the "*diffi-*

*culties''* of the science, quite naturally, as it would seem, though he does not expressly assert that these age-separated formations are often conformable to one another, as Geikie and Darwin have said in the quotations given above.

Suess, however, is much more explicit, for he declares that there are "numerous examples" of "*concordant* superposition of the more recent beds on those of much greater age." We need not reproduce the specific examples he mentions, and need only quote his remark that comparatively "young" rocks often "rest in perfect concordance on much older beds, so that the stratigraphical relations offer *no hint of the great gap* which occurs at the line of contact." (Vol. 2, p. 543.) All of which, he says, "may well be cause for astonishment."

The literature really teems with illustrations of these facts, and the more detailed accounts contained in the various Geological Reports are often quite charmingly naive in their description of the conditions. Two examples, however, must suffice, both from the Canadian Northwest.

The first is from the Report on the region about Banff, in Alberta, near the line of the Canadian Pacific Railway, and just east of the Rockies:

> East of the main divide the Lower Carboniferous is overlaid in places by beds of Lower Cretaceous age, and here again, although the two formations differ so widely in respect to age, one overlies the other without any perceptible break, and the separation of one from the other is rendered more difficult by the fact that the upper beds of the Carboniferous *are lithologically almost precisely like those of the Cretaceous*

[*above them*]. *Were it not for fossil evidence, one would naturally suppose that a single formation was being dealt with.— Canadian "Annual Report," New Series, Vol. 2, Part A, p. 8.*

The other example is from the District of Athabasca:

The Devonian limestone is apparently succeeded conformably by the Cretaceous, and with the possible exception of a thin bed of conglomerate of limited extent, which occurs below Crooked Rapid on the Athabasca, the age of which is doubtful, the vast interval of time which separated the two formations is, so far as observed, unrepresented either by deposition or erosion.—*"Annual Report," New Series, Vol. 5, Part D, p. 52.*

Of course, some geological writers labor to explain this thundering rebuke of their theory, just as the Ptolemaic astronomers had their "deferents" and "epicycles" for every new difficulty. But surely the detailed records of such observations as these are fearful examples of the power of tradition to blind the minds of investigators to the meaning of the very plainest facts.

On a previous page (*Id.*, p. 51), the author last quoted gives us some idea of the "remarkable persistence" of this instructive case of conformability, which extends from the Athabasca "in a broad band around the southern end of Birch Mountains, and across Lake Claire to Peace River, and up the latter stream to a point two miles above Vermillion Falls."

The distance, as I judge from the map, can not be less than 150 miles in a straight direction, thus making a district of probably several thousand square miles in extent where, according to the theory of a

life succession, nature must have put an injunction on the action of the elements, and they had to continue in the *status quo* for millions of ages, or from the Devonian to the Cretaceous "age," the water neither wearing away nor building up over any part of this consecrated ground during all this time. No wonder Suess says that such things "may well be cause for astonishment." ("The Face of the Earth," Vol. 2, p. 543.)

Nor is this all, for in this same Report (Part E, p. 209), we are told of strata near Lake Manitoba, over 500 miles away, in almost the same wonderful relationship,—"Devonian rocks very similar in character" to those in Athabasca still overlaid directly by the Cretaceous, though in this case as it happens "unconformably." It would almost seem to be a *bona fide* case of Werner's onion-coats cropping out.

And all this incredible picture of nature's inconsistent behavior in past ages is necessitated solely by the loving allegiance with which the infallibility of the life succession theory is regarded by modern geologists.[2]

[2] In the earlier and more rational days of geology, many writers used to remark how all the fossiliferous deposits were closely connected with one another, while being everywhere unconformable to the Archæan or the Primitive, and also unconformable to the Recent. De la Beche and Phillips may be especially mentioned in this connection. Another geological writer, Dr. George Young, author of "A Geological Survey of the Yorkshire Coast," in a paper communicated to the Geological Section of the British Association, 1838, remarks: "In fact, although in describing them we may distinguish a succession of deposits, they are so connected together as to form one whole,—one grand deposit; leading us to conceive that *one age* might give birth to the entire series. . . . However numerous the beds, and however we may attempt to subdivide them, they are but parts of the same whole; and instead of being very slowly formed during a long succession of ages, *they bear the marks of having been deposited about one period.*"

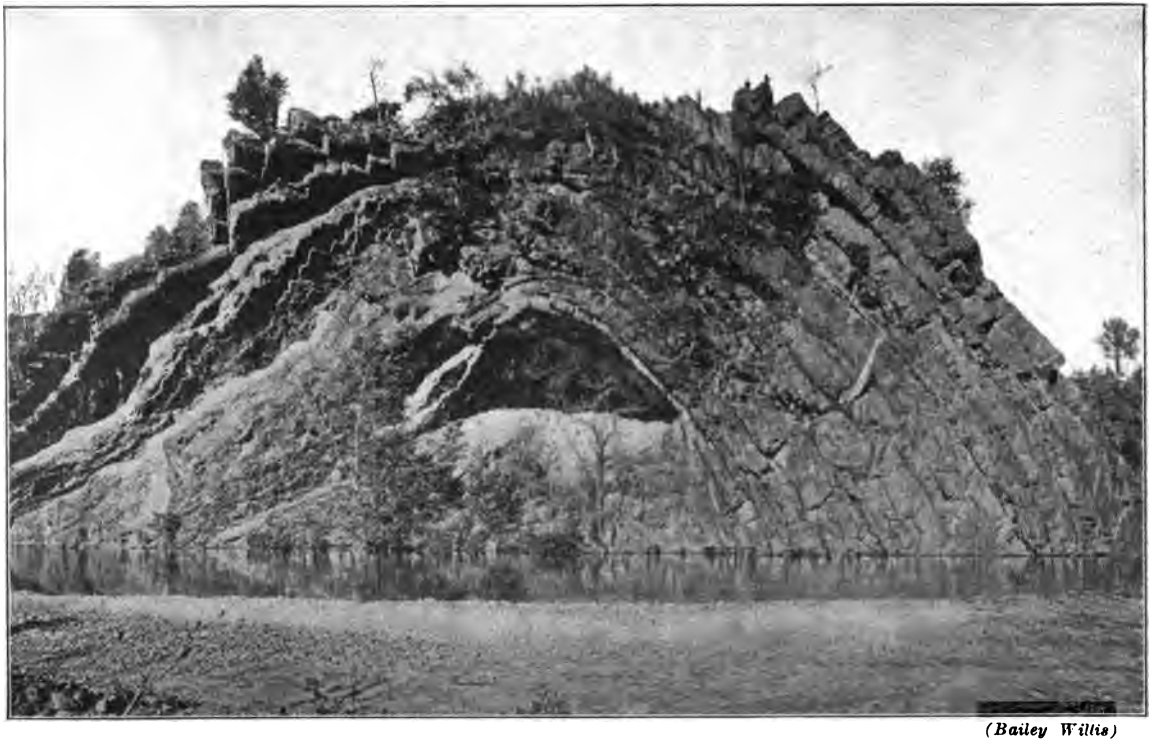
# CHAPTER V

## Turned Upside Down; Fact Number Three

It is a law of the human mind, that in all scientific inquiry we generally find what we are looking for; in other words, nature will only answer us when we put to her leading questions, or when we shape our questions so they can be answered by *yes* or *no*. "Nature," says Sir E. Ray Lankester, in his essay on *Degeneration*, "gives no reply to a general inquiry — she must be interrogated by questions which already contain the answer she is to give; in other words, the observer can only observe that which he is led by hypothesis to look for."

For nearly a hundred years the rocks in all parts of the world have been interrogated in the terms of a single theory; and since this theory has been treated constantly as an axiomatic fact which it would be folly to question or disregard, an affirmative answer has always been extracted from the rocks sooner or later, though often the methods employed to elicit such an answer remind us very much of those employed in other days to get the desired answer from obstinate heretics.

Every student of mountain structure becomes impressed with the mighty forces that have acted upon the strata in folding, twisting, and contorting them.



*(Bailey Willis)*

FIG. 3 — FOLDED ROCKS. ANTICLINE IN SILURIAN STRATA ON THE POTOMAC RIVER, NEAR HANCOCK, MARYLAND

This is a very good average example of folded strata. But how thick was the mass of beds involved in this fold? For, as Sir Joseph Prestwich has pointed out, "if a solid plate of any kind be broken and the fractured edges turned up by reciprocal pressure in presence of a resisting body beneath, the width of the protruding mass will bear a definite relation to the thickness of the plate. If, on the other hand, the plate is sufficiently pliable to yield without fracture and should be bent into folds, *the height of the arches and the width across the folds will in like manner be proportionate to the thickness of the plate.*" ("Controverted Questions of Geology," p. 151.) Geologists are still puzzling over the problem of the cause of this folding of the rocks; for in some instances the upper strata may even be folded up in this way while the underlying strata are still unaffected, but appear to be in their normal position. What was the real cause nobody knows.

But often the interpretation of the record has been made unnecessarily complicated and even incredible by trying to make the beds confirm this prearranged order in which it was supposed they must occur. Thus when we are told by a standard authority like Dana, that one of the great folds of the Alps "has put the beds upside down over an area of 450 square miles" ("Manual," p. 367), we very naturally ask, What evidence is there of such an awful and incredible catastrophe? Most of the folds in the mountains that we can really follow up and trace out in detail are to be measured in feet and yards, not in miles or geographical degrees. Ought we not to expect and to demand the most positive evidence if we are to believe that old Mother Earth ever turned such a huge calcareous and silicious pancake as this describes? In other words, while every intelligent man knows that the rocks have in many instances been tilted up at various angles or perhaps even overturned, yet the thickness of the strata thus involved and the size of the folds thus made (see Fig. 3) are in all cases so inconsiderable that the unsophisticated man is compelled to look with suspicion on statements like this that speak of a whole country being

found upside down; and his incredulity is not at all diminished on finding that in such instances the only evidence we have of such an astonishing event is that the strata are here in the wrong order, the "older" fossils being on top, and the "younger" ones underneath, over these immense tracts of country.

But let us retrace our steps somewhat, and pick up the thread of our argument. We have already found quite serious reason to question the accuracy of this life succession theory; but there is still another way of testing its rationality. If certain fossils are not necessarily older than certain others, it might reasonably be expected that we would now and then find them reversed as to position; that is, with the "younger" below and the "older" above. Accordingly we have the following very necessary caution from Professor Nicholson:

> It may even be said that in any case where there should appear to be a clear and decisive discordance between the physical and the palæontological [fossil] evidence as to the age of a given series of beds, it is the former that is to be distrusted rather than the latter.—"*Ancient Life History of the Earth,*" *p. 40.*

Humorous? Not at all; the theory requires it, and therefore quite seriously we are told, in effect, (1) that there has been a succession of life on the globe *because* the fossils always occur in a certain relative order of succession, and (2) that whenever they are found in the *reverse* order, we must distrust the positive evidence of all our senses, and say that somehow the "older" beds have been put on top, and those below are really "younger," but in the wrong

position. And yet some people have even wished to class this sort of geology among the exact sciences!

To meet all ordinary cases of this character, where the differences involve only a few horizons representing only a few "ages" or a mere fraction of the total of "geological time," the theory of pioneer "colonies" was invented by Barrande in 1852. Ten years later appeared Huxley's famous essay on "Homotaxis," already quoted from in chapter 1; but this, instead of pointing the way for a complete reconstruction of geological theory as it ought to have been allowed to do, seems only to have been used to help explain away the troublesome evidence in such upside-down conditions as the Pikermi beds in Greece, which contain typical Miocene types, but rest on late Pliocene strata; or the Gondwanas of India, which contain a Rhætic flora, but overlie a Jurassic flora, with a Triassic fauna above both; or the Newcastle beds in Australia, where a Jurassic flora is inextricably mixed up with a Lower Carboniferous fauna, with Permian beds over all; to say nothing of many cases nearer home, such as the Dakota beds of America, where fossils that ought to be classed as Tertiary have undisputed Cretaceous beds above them. Such, however, are only the ordinary difficulties of the theory, encountered in every considerable region penetrated by geological exploration.

But for extreme cases, say where Cambrian or other Palæozoic fossils occur above Jurassic, Cretaceous, or Tertiary, there is in such a predicament

always an anxious search made for faults and displacements; and if others are not to be found, the stratification planes separating the beds are called "faults," and then we are confidently told that immense mountain masses, perhaps covering thousands of square miles, have been pushed up on top of the younger rocks, where they now lie in what looks exactly like a normal position with nearly horizontal stratification. Albert Heim of Switzerland was perhaps the first to teach the scientific world to speak of huge "overthrust folds," mapping them out with imaginary arcs of circles miles high in the air as the place where these folds once were, and such explanations are not yet entirely discarded. But of late years the theory of "thrust faults," with the mountains pushed bodily up on top of the other strata, has become the more popular method of explanation, and there is scarcely an artificial geological section made within recent years that does not contain one or more of these "thrust faults." (See Fig. 18.) But the really important thing to remember in this connection is that it is solely because the fossils are found occurring in the wrong order of sequence that any such devices are thought to be necessary,— devices which, as has already been suggested of similar expedients to explain away evidence, deserve to rank with the famous "epicycles" of Ptolemy, and will do so some day.

Here is Geikie's amazing style of argument to prove the reality of such great earth movements:

We may even demonstrate [?] that in some mountainous ground the strata have been turned completely upside down *if* we can show that the fossils in what are now the uppermost layers *ought properly* to lie underneath those in the beds below them.—*"Text-Book," p. 837, ed. of 1903.*

Some day, I fancy, such a statement will be regarded as one of the curiosities of the history of scientific theories. But this is no isolated expression wrested from its context; it is the fundamental method employed in all modern geological investigation, and well illustrates what Sir Henry Howorth calls the "singular and notable fact that, while most other branches of science have emancipated themselves from the trammels of metaphysical reasoning, the science of geology still remains imprisoned in '*a priori*' theories." ("The Glacial Nightmare," Preface 7.)

Here is another statement of the same general import, taken from this standard text-book, regarding some conditions in the Alps:

The strata could scarcely be supposed to have been really inverted, save for the evidence [?] as to their true order of succession supplied by their included fossils. . . . Portions of Carboniferous strata appear as if regularly interbedded among Jurassic rocks, and indeed could not be separated save after a study of their enclosed organic remains.—*Id., p. 678.*

Plenty of striking examples of such upside-down conditions have come to light in recent years, but we have here room for the details of only one or two. But these are typical of the rest; and I believe they are quite sufficiently obvious in their meaning to prove that the rocks were really laid down in the order in which we now find them.

The first instance is from a part of Alberta just east of the Rocky Mountains, where the Canadian Pacific Railway enters the foot-hills. (See frontispiece.) Here the whole of the Fairholme Mountain, east of Banff, and north of the railway and the Bow River, consists of Cambrian limestones, and yet they rest apparently conformably on Cretaceous shales. R. G. McConnell, of the Canadian Survey, who first described it, remarks with amazement on the way in which the line of separation between the shales and the limestone, what the current theory is compelled to call the "thrust plane," resembles in all respects an ordinary stratification plane. For he says:

> The angle of inclination of its plane to the horizon is *very low,* and in consequence of this its outcrop follows a very sinuous line along the base of the mountains, *and acts exactly like the line of contact of two nearly horizontal formations.*
>
> The best places for examining this fault are at the gaps of the Bow and of the south fork of Ghost River. At the former place the Cretaceous shales form the floor of the bay which the Bow has cut in the eastern wall of the range, and rise to a considerable height in the surrounding slopes. Their line of contact with the massive gray limestones of the overlying Castle Mountain group is well seen near the entrance to the gap in the hills to the north. The fault plane here is nearly horizontal, and the two formations, viewed from the valley, *appear to succeed one another conformably.*—*"Annual Report," 1886, Part D, pp. 33, 34.*

This author further declares that the underlying Cretaceous shales are "very soft," and "have suffered little by the sliding of the limestone over them." (P. 84.)

But what an amazing condition of affairs is this!

Here are great mountainous masses of rock, very similar in mechanical and mineral make-up to thousands of examples elsewhere. The line of bedding between them "acts exactly like the line of contact of two nearly horizontal formations," and in a natural section cut out by a river the two "appear to succeed one another conformably." And yet we are asked to believe that all this is merely an optical illusion. The rocks could not possibly have been deposited in this way, for the lower ones contain "Benton fossils" (Cretaceous), and the upper ones are Cambrian, and almost the whole geological series and untold millions of years occurred after the upper one and before the lower one was formed. *Solely on the strength of the infallibility of a theory invented a hundred years ago in a little corner of Western Europe, which "promulgated, as respecting the world, a scheme collected from that province," and assumed that over all the world the rocks must always follow the order there observed, we are here asked to deny the positive evidence of our senses* BECAUSE *these rocks do not follow this accepted order.* I must confess that I can not see the force of such a method of reasoning. It is carrying the argument several degrees beyond the reasoning of the three little green peas in the little green pod, as narrated in the exquisite fable of Eugene Field. These wise little fellows noticed that their little world was all green, and they themselves green likewise, and they shrewdly concluded from this that the whole universe must also be green. But we are

not told of their traveling abroad and persisting in a systematic attempt to explain all subsequently observed facts in terms of their theory.

The accompanying photograph (Fig. 4), which shows a part of this Fairholme Mountain as viewed

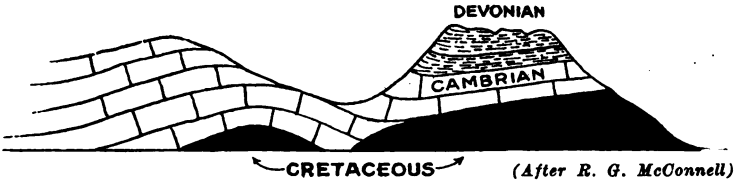
*(Photograph by Rollin T. Chamberlin)*

FIG. 4 — CAMBRIAN LIMESTONE RESTING ON CRETACEOUS SHALE

Looking north from near Kananaskis Station, Alberta. This is the eastern part of the great mountain mass that the theory says has been pushed up into its present position, though the limestone rests on the shale conformably, as described in the text.

from near Kananaskis Station on the railway, is supplied by the courtesy of Prof. R. T. Chamberlin, of the University of Chicago, who examined this region in the summer of 1910, and who says that he found "what appears to be a continuation of this same thrust plane a hundred miles further south, on

the Crow's Nest branch of the Canadian Pacific Railway." Thus according to the common theory, this whole region of country must have been pushed




*(After R. G. McConnell)*

FIG. 5 — Section along South Fork of Ghost River, being nearly identical with the part shown in the previous photograph, showing relations of Cretaceous to Cambrian.

bodily forward for a distance of many miles to get these rocks into their present position.

But before describing this area in detail, we must go some fifty miles still further south, or over a hundred and fifty miles south of the mountain described above by McConnell, to a region in Northern Montana, a map of which is given in Fig. 8. The

*(After G. M. Dawson)*

FIG. 6 — Crow's Nest Mountain, Alberta, from a high ridge about three miles east. The summit of this mountain, like that of Chief Mountain, fifty miles or so to the south, which it very much resembles, consists of Algonkian limestone resting on Cretaceous "in a nearly horizontal attitude." (G. M. Dawson.)

light part of this map represents the Cambrian or Pre-Cambrian rocks, which, according to the theory, have also been pushed bodily for many miles over


*(From Bailey Willis, Bull. Geol. Soc. Am., Vol. 13, 1901)*

FIG. 7 — CHIEF MOUNTAIN, LEWIS RANGE, MONTANA

on top of the Cretaceous shales, represented by the darker portion. The accompanying photograph of Chief Mountain (Fig. 7), which stands somewhat alone just south of the 49th parallel, gives a typical view of these two sets of rocks, and shows how much more natural it would be to think that these rocks represent an ordinary position, than to imagine such a gigantic earth movement as the theory demands. Figs. 9, 10, 11, and 12 show the appearance of other mountain masses in this same general area; and these mountains also must have been part of this great mass pushed forward over the Cretaceous.

Space forbids us to quote at length from the very interesting paper of Mr. Bailey Willis (Bulletin Geological Society, Vol. 13, pp. 305-352), from which this map and some of the accompanying photographs are taken. He estimates that the Cretaceous rocks underneath the top of Chief Mountain are 3,500 feet thick; while the so-called thrust plane, he says, "is essentially parallel to the bedding" of the upper series. (P. 336.)

This apparently is true not only of the segments of thrust surface beneath eastern Flattop, Yellow, and Chief mountains, but also of the more deeply buried portion which appears to dip with the Algonkian strata into the syncline. While observation is not complete, it may be assumed on a basis of fact that thrust

Looking east along Chief Mountain ridge. *Ae*, Algonkian limestone; *Kb*, Cretaceous — Benton shale. This mountain, which is situated almost on the boundary-line between the United States and Canada, is merely a little outlier of a large tract of country about 350 miles long by 20 or 30 miles wide, extending from the Yellowhead Pass, Alberta, to the Sun River Canon, west of Great Falls, Montana. Maps of this region are shown in frontispiece and on page 93. Over all this region the tops of the mountains consist of this same sort of Algonkian (Paleozoic) limestone, resting in a perfectly natural manner, often *conformably*, on Cretaceous shales. Over how much more of the earth's surface would we have to find the rocks in this "upside-down" order before scientific men would acknowledge that the geological "ages" are only a big blunder, and the whole evolution theory a piece of elaborate nonsense founded on a blunder!

surfaces and bedding are nearly parallel over extensive areas.— *P. 336.*

A further interest attaches to this region from the fact that it contains the main continental divide between the Atlantic and Pacific oceans, as well as between Hudson Bay and the Gulf of Mexico, for streams from this region join the Saskatchewan, the Missouri, and the Columbia River. *Thus the very roof of North America consists of a cap of Algonkian or Pre-Cambrian limestone resting in what looks like a perfectly natural way on Cretaceous beds.* The area shown on the accompanying map is nearly thirty miles from north to south, but the region thus affected really extends considerably further south (see F. H. H. Calhoun, Professional Paper No. 50, p. 10); while instead of the seven miles spoken of by McConnell, which is given as the "displacement" that has been "observed," Willis says that "an equivalent amount" of movement underground must be taken into consideration. (P. 341.) Marius R. Campbell, of the Washington Survey Staff, who visited this region in the summers of 1910 and 1911, reports positive evidence that this great "overthrust" is "not less than fifteen miles" from east to west, "almost every foot of which is clearly exposed." (Letter to the author.)

But all this is only the beginning of the story. We must return to the north, to note again the Crow's Nest Mountain, which G. M. Dawson, of the Canadian Survey, says "in its structure and general appearance much resembles Chief Mountain" ("Annual Report," 1885, Part B, p. 67), its summit

consisting of this same type of limestone, "in a nearly horizontal attitude," resting on the Cretaceous. (See Figs. 6 and 7.) And it is this region that Professor Chamberlin says "appears to be a continuation" of the thrust plane a hundred miles further north described by McConnell.

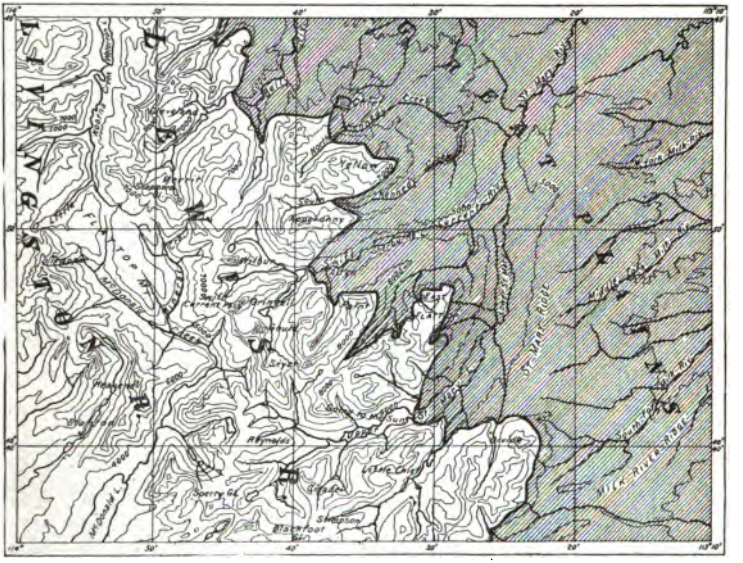
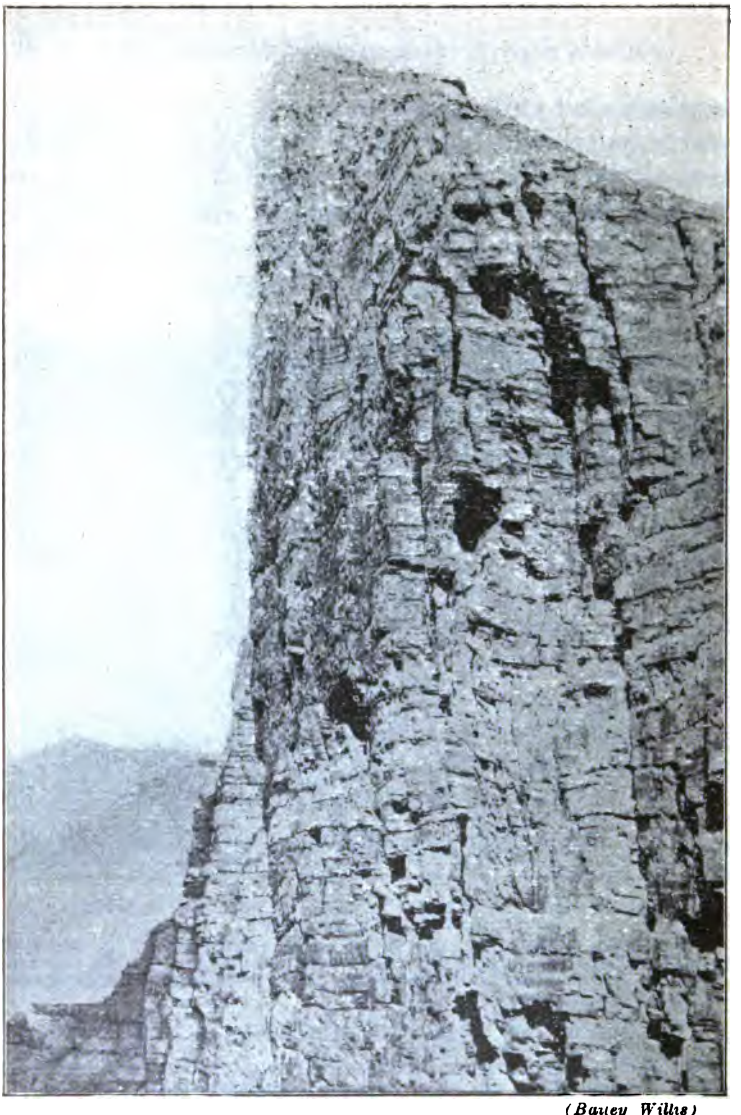


FIG. 8 — MAP OF GREAT PLAINS AND FRONT RANGES NORTHWEST MONTANA

(Reduced from Browning and Chief Mountain atlas sheets, U. S. Geological Survey.) Shaded area, Cretaceous rocks; white area, Algonkian rocks. According to the current theory, all these Algonkian or Pre-Cambrian rocks must have been pushed up on top of the Cretaceous.

We have now seen the characteristic features of this vast area, north, and south, and near the middle, though it really extends another hundred miles further north, as we shall presently see. Parts of the intervening area are not yet (1912) well explored,



*(Bailey Willis)*

FIG. 9 — GOATHAUNT, LEWIS RANGE

A spur of Mount Cleveland, Montana. The view is looking northwest, and is a typical exposure of Siyeh limestone, a subdivision of the Algonkian; portion of cliff in view about 1,200 feet high; base below view descends nearly vertically as far again. Goat trails extend across cliff face. This mountain is directly west of Chief Mountain, and according to the theory, is a part of the great mass that has been pushed up on top of the Cretaceous.

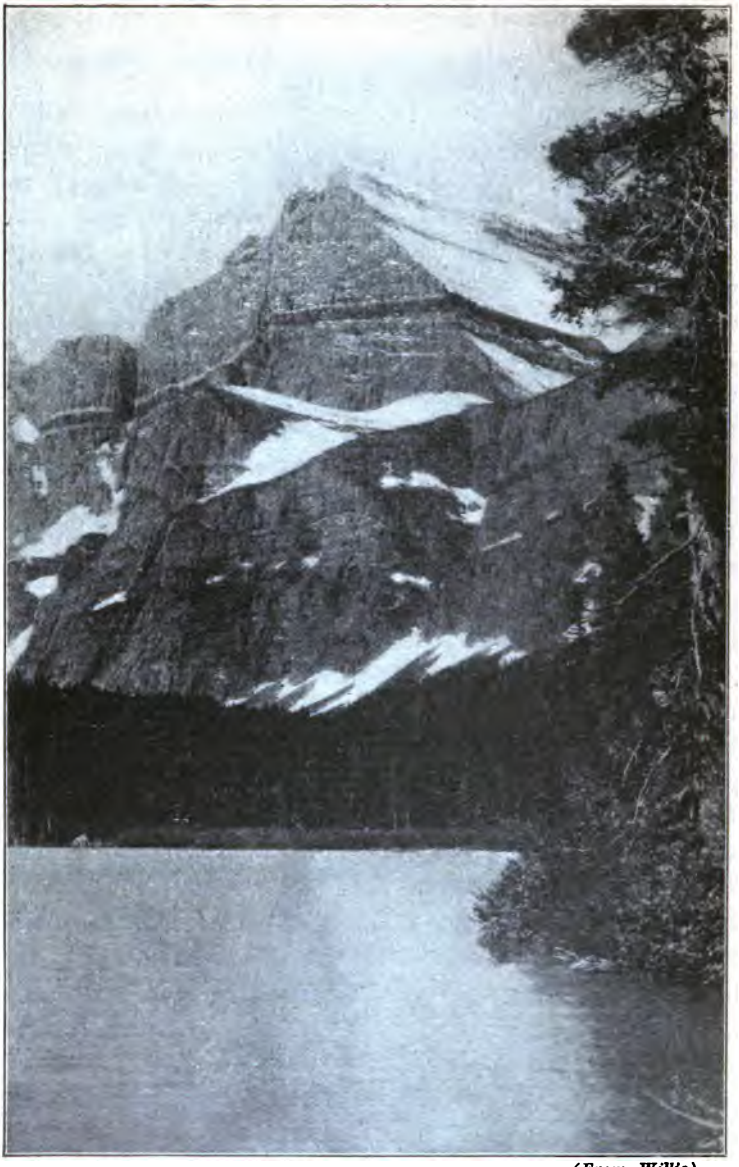
but so far as it has been examined the same conditions are found to prevail. The very same lithological and geological structures recur over all this region with the persistence of a repeating decimal. The tops of the mountains, often their entire masses, consist of the same jointed limestones and argillites, like the tops of Chief and Crow's Nest mountains, which by the erosion of the soft underlying shales are left standing in rectangular, cathedral-like masses, easily recognizable as far off as they can be seen. (See Fig. 9.) And all around these Cambrian or Pre-Cambrian limestone mountains, wherever the rivers have eroded the valleys down deep enough, they have laid bare the soft Cretaceous beds, which dip gently under the Palæozoic limestone or underlie it horizontally, exactly like any normal stratification plane. A more positive rebuke to the theory of geological succession could not well be imagined, for these Palæozoic rocks are supposed to be the very "oldest" rocks on earth, while the Cretaceous are pretty nearly the "youngest"; and yet were it not for the exigencies of the theory, this whole region would be considered as only an ordinary example, on rather a large scale, of nearly horizontal stratification cut up by erosion into mountains of circumdenudation, with of course occasional instances of minor disturbances here and there, as are always to be found in an area of this extent.

West of the Fairholme Mountain, spoken of above, in the latitude of the Bow River and the Canadian Pacific main line, lies a long, narrow

FIG. 10 — MOUNT RUNDLE, BANFF, ALBERTA
The mountain also consists of Cambrian or Pre-Cambrian rocks resting on the Cretaceous

valley of Cretaceous beds, sixty-five miles long, called the Cascade Trough on the accompanying map. (Frontispiece.) The beds of this Trough run up to the abrupt bases of Mount Rundle (Fig. 10) and Cascade Mountain on the west, the latter being a part of the Sawback Range. In this latitude, or just north of the 51st parallel, the total width of this wonderful area is about twenty-five miles, and there is only one Cretaceous valley running north and south. Some thirty miles farther south, there are two parallel Cretaceous valleys, and in some places three; while just south of the 50th parallel, at Gould's Dome, *there are five parallel ranges of these Palæozoic mountains, with four Cretaceous valleys intervening,* one of them, the Crow's Nest Trough, being ninety-five miles long, as stated by Dawson.

It would not be profitable to enter into further details, but we ought now to get a broad view of the total area involved. The Hon. R. W. Brock, director of the Canadian Geological Survey, informs the writer that "all the Rocky Mountain tract up to the Yellowhead Pass may safely be included" in this great faulted area, adding, "North of the Yellowhead it no doubt extends, but we have not sufficiently detailed information to set boundaries." Its southern limits are almost equally indefinite, Dr. George Otis Smith, director of the United States Survey, informing the writer that this great "fault," as it is termed, has been traced "southward to the crossing of the Great Northern Railway, and it is probable that it extends still further to the south,



*(From Willis)*

FIG. 11 — MOUNT GOULD, LEWIS RANGE, MONTANA

**From South Fork of Swift Current, looking southwest. From lake to summit, 4,670 feet, or 9,541 feet above sea-level. This mountain also consists of Algonkian limestone, and is a part of this immense tract of country that has traveled eastward, according to the theory; for it overlies the Cretaceous.**

as a fault of similar character has been noted at the head of Sun River, west of Great Falls," near the central part of Montana. Thus this region, which is rapidly becoming famous in geological circles as the "great faulted area," must be about *three hundred*

*(From Willis)*

FIG. 12 — NORTH SIDE OF SWIFT CURRENT VALLEY NEAR ALTYN, MONTANA

Looking east. Typical Altyn Limestone cliff (Algonkian), overlying Benton (Cretaceous) shale. Though these rocks seem to be in a perfectly normal position relative to one another, the theory demands that the upper rocks must have been pushed up on top of the lower.

*and fifty miles long,* north and south, with an average width of perhaps twenty miles at least from east to west, making a total area of some *seven thousand miles.* Further investigation is more likely to increase this area than to diminish it, though it is quite

possible that our more detailed knowledge may find occasional interruptions to the marvelously uniform character of these Palæozoic rocks on top of the Cretaceous, especially since there is in some places a regular alternation of Palæozoic and Cretaceous, as has occurred in the Alps and elsewhere. (See pp. 74, 85 of this volume.) Besides, complications and misinterpretations may be expected to arise from the fact that the resemblance between the Cretaceous shales and the Banff series of the Palæozoic is "so close that it becomes impossible in many places to separate them without fossil evidence," as R. G. McConnell naively remarks of the portion of this region that he describes. For throughout the central portion of this area, as this author declares, "notwithstanding the complete absence of all the intervening formations, no unconformity was anywhere detected between them, except where faulting is known to have occurred,"— that is, where they are found in the upside-down order. "The apparent conformity is perfect, even in the clearest sections, and the difficulty in drawing an exact line between the two series is further increased by the close lithological resemblance" between them. (*Annual Report,* 1886, Part D, p. 17.)

The very obvious naturalness of these Palæozoic rocks resting upon the Cretaceous, as well as the immense area involved, makes this example a crucial one in disproof of this whole theory of life succession. Why should such facts be blinked or tortured to save such a theory? I have nothing at all to say

against real faults or real folds in the strata, when they can actually be seen and proved objectively. Every one who has traveled with his eyes open in any mountain region on earth, even though he be not a geologist, knows that there are such things as faults and such things as folds, though they are usually to be measured in feet and yards, instead of in miles and degrees of latitude and longitude. But when the upper strata have every objective appearance of being now in their normal position, so much so that they may even appear to be conformable to the beds below them over miles of area, and the only suggestion of a thrust fault or an overthrust fold is that the fossils are here in the wrong order, every law of inductive reasoning commands us to take the objective fact instead of the *a priori* theory.

In the calm safety of our libraries we may talk composedly of an immense mountain region having been "turned upside down over an area of 450 square miles," as Dana does, or of several thousand square miles of mountains having traveled bodily forward for fifteen or twenty miles; but those who speak thus are surely using words without any mental equivalent. In short, it is time to speak out what every reader has already said in his innermost soul, that such great earth movements would be incredible in the face of any amount of evidence; but when the physical evidence is all against them, and nothing demands such incredible dislocations except an otherwise highly questionable theory, common sense


*(Courtesy of Dr. Albert Heim)*

FIG. 13 — SOUTH SIDE OF THE SEGNES PASS, GLARUS, SWITZERLAND

tells us to throw away such a theory and adopt the most obvious explanation of the facts, namely, that these rocks were really laid down in the order in which we find them.

But why may we not be allowed to say that these rocks are in a normal order, and that the Cretaceous were throughout this whole area generally deposited before the Palæozoic? Is modern science to be eternally obliged to say that William Smith and Cuvier and Werner were gifted with a supernatural knowledge of how the rocks must always be found to occur in other parts of the world? And whenever they are found in the contrary order, must we believe any incredible fiction in plain contradiction to our eyesight and common sense rather than impugn the memory of such supernatural wisdom? *How much of the earth's crust would we have to find in this upside-down condition in order to discredit this life succession theory?* What conditions of the strata could be found to convince modern scientists that we have for all these years been following a fantastic theory and an unscientific method? Language fails me; for I don't know what would convince the world, if this evidence here in Alberta and Montana is insufficient.

It is narrated that in one of Daniel Webster's legal battles the point in dispute turned upon the differences or the identity of two car-wheels. The opposing counsel, by a learned and eloquent address, had pictured to the jury a number of minute and subtile distinctions that he claimed could be made

between them. When Webster's turn came, he pulverized the work of the previous hour or more with one sentence: *"But there they are, gentlemen; look at them!"* And so I am sure that all the labored and fantastic explanations that are given to account for how these Palæozoic limestones came to be on top of these Cretaceous beds, ought to vanish into thin air in the presence of one illuminating glance at them lying here in apparently normal sequence, often parallel to one another in bedding, and over miles and miles of country looking exactly like perfect conformability. Not only common sense, but every principle of sound logic and true Baconian science, forbids our surrendering the positive evidences of our senses to save an out-of-date theory.

In the Southern Appalachian Mountains of Eastern Tennessee and Northern Georgia, "an almost identical structure" (McConnell) is to be found, Carboniferous strata dipping gently to the southeast, like an ordinary monocline, *under* Cambrian or Lower Silurian, one of these so-called faults having a reported length of 375 miles (Bailey Willis, Geological Survey, Annual Report, Vol. 13, p. 228), while in another instance the upper strata are said to have been pushed something like eleven miles in the direction of the thrust. (C. W. Hayes, Bulletin Geological Society of America, Vol. 2, pp. 141-154.) These conditions, we are told, "have provoked the wonder of the most experienced geologists" (Willis, *op. cit.*, p. 228), because of the perfectly natural appearance of the surfaces of the strata thus affected; or as

the latter writer puts it, "The mechanical effort is great beyond comprehension, but the effect upon the rocks is inappreciable," and "the fault dip is *often parallel to the bedding* of one or the other series of strata" (*Id.*, p. 227); or in other words, the so-called thrust plane looks exactly like an ordinary stratification plane between conformable strata.

Without entering into further details here, we must pass over to the Highlands of Scotland, where, as Dana says, "a mass of the oldest crystalline rocks, many miles in length from north to south, was thrust at least ten miles westward over younger rocks, part of the latter fossiliferous;" and he further declares that "*the thrust planes look like planes of bedding, and were long so considered.*" ("Manual," pp. 111, 534.)

Geikie quite naturally devotes several pages in his "Text-Book" to a description of these conditions in the Highlands; but from one of his first reports on these observations, published in *Nature* (Nov. 13, 1884, pp. 29-35), we get some much more suggestive details.

The thrust planes, he says, are difficult to be "distinguished from ordinary stratification planes, like which they have been plicated, faulted, and denuded. Here and there, as a result of denudation, a portion of one of them appears capping a hilltop. One almost refuses to believe that the little outlier on the summit does not lie normally on the rocks below it, but on a nearly horizontal fault by which it has been moved into its place."


FIG. 14 — MAP OF GLARUS AND VICINITY, SWITZERLAND

Speaking of some similar conditions in Ross Shire, which he himself, before the fossil evidence had been worked out, had described as naturally conformable, he declares:

> Had these sections been planned for the purpose of deception, they could not have been more skilfully devised, . . . and no one coming first to this ground would suspect that what appears to be a normal stratigraphical sequence is not really so.

"When a geologist finds" things in this condition, he says, "he may be excused if he begins to wonder whether he himself is not really standing on his head."

But it would be unprofitable to pursue this subject further, no matter how entertaining it might be in illustrating the ludicrous, childlike faith in this theory exhibited by illustrious men who are otherwise clear reasoners. Those who wish to do so may find additional examples of the strata in these upside-down conditions throughout the larger works of Dana, Le Conte, Prestwich, Geikie, and Suess, to say nothing of the more detailed statements given in the numerous government reports of all the English-speaking countries, and ponderous monographs in German and French by such men as Heim, Schardt, Lugeon, Rothpletz, etc. The latter, for example, describes how, in the district about Glarus, an enormous mass of mountains must have "traveled from east to west a distance of twenty-five miles from the Rhine Valley to the Linth," while in the east of Switzerland the "Rhætikon Mountain mass trav-

FIG. 15 — LINTHAL, CANTON OF GLARUS, SWITZERLAND

eled from the Montafon Valley to the Rhine Valley, about nineteen miles from east to west." (*Nature*, Jan. 24, 1901, p. 294.)

The following summary of the situation in the Alps is given by Prof. Albert Heim, in an address at Zurich in 1907:

> As in Glarus (Figs. 14 and 15) the valleys are cut down into the young Tertiary rocks, while the mountain peaks are crowned with the old Permo-Carboniferous (Sernifit), so also, for example, the Nikolai Valley is cut down through the Jurassic and the Triassic, and the old crystalline schists form in the Matterhorn (Fig. 16), Dent Blanche, and Weisshorn the overlying cover of a northerly directed overthrust fold. And in the very same manner the valleys of Schams and Rheinwald cut into Triassic schists, while the cliff-like tops round about are crowned with faulted caps of other older rocks of southern origin (for example, the limestone mountains of Splügen). *Thus we see that very many mountains of our Alps are composed, in their upper formations, of faulted older rocks which lie on top of younger ones* without any direct connection with the bottom. . . . These flat-lying faults, of which the Glarus folds were the first to be discovered, are a universal phenomenon in the Northern and the Central Alps, and their origins lie in the central and the southern regions.—*"Der Bau der Schweizeralpen," p. 17.*

The Carnegie Research Expedition in Asia recently reported one of these great "folds" across Northern China for the distance of 500 miles, but say that "to what extent these structures are general in North China is not yet determinable." ("Research in China," Vol. 2, p. 90.) But enough! What we really need is not more facts along this line, but a more candid, a more truly scientific attitude of mind in considering the facts we already have. For

FIG. 16 — THE MATTERHORN, CANTON OF VALAIS, SWITZERLAND

in no other branch of natural science is there such a theory still surviving from the past age of subjective speculation, which is still treated as a Procrustean bed to which all subsequently discovered facts must be compelled at any cost to conform,— not another one for which otherwise competent observers will thus freely sacrifice their common sense. When the dividing line between two sets of strata "acts exactly like the line of contact between two nearly horizontal formations," so much so that in a natural section cut out by a river the two "appear to succeed one another conformably," surely a calm judicial mind, divested of all theoretical prejudice, instead of talking about these conditions having been planned by nature "for the purpose of deception," will find no difficulty at all in believing that these rocks were really laid down in the order in which we now find them, the "younger" first and the "older" afterwards; and only one under the hypnotic spell of a preconceived theory would, at the suggestion of such a fact, begin "to wonder whether he himself is not really standing on his head."

# CHAPTER VI

## Fact Number Four

After what has been proved in the previous pages, and especially in the last chapter, the author feels that he owes an apology to the intelligent reader for pursuing this line of argument further. It is too much like mutilating an enemy already dead. For in the light of the facts already brought forward, the scheme of chronological ages is seen to be not only unproved, but impossible and absurd. And yet since the plan of the present volume embraces a complete review of the whole question in such a way that the subject will never need to be reopened, we beg leave to present one more fact,— very slight, indeed, compared with some already presented, and yet enough to have occasioned no little discussion among perplexed geologists, and of considerable importance in rounding out a full discussion of these successive ages.

There is only one class of agents now working upon the rocks of the globe which have been in business continuously ever since the dry land appeared, and which have left us a legible record of approximately the amount of business they have been doing all these centuries. And my Fact Number Four, which will complete this line of argument in illus-

trating the antagonism between the facts of the rocks and the theory of life succession, is that the rivers of the world, which of course are the agents to which I have referred, in traveling across the country, *act precisely as if they knew nothing of the varying ages of the rocks,* but on the contrary treat them all alike, as if they were of the same age, and *as if they began sawing at them all at the same time.* Of course it is evidently in only a few cases where the records are so free from ambiguity as to be quite incapable of being misunderstood; that is, the cases of rivers with steep rocky gorges, or those that cut through mountain ranges. But there are several such rivers in the world, and they all seem to tell the same story.

The famous Colorado River is a good example. (Fig. 19.) It flows from "younger" strata into "older" in its deep cutting across the Arizona plateau.[1] That is, the rocks in the lower part of this river are "older" than those further up toward its source. Stated in terms of the current theory, this means that when the region of country about the lower part of this river's course first became dry land, the upper part was still sea, and that thus there was no such river in existence here until the very "youngest" of these rocks was formed. For otherwise the river must have started running from the sea toward the dry land, that is, running up-hill. Stated in terms neutral as to theory, it means that the whole of this region of country, drained by this

[1] See Zittel, "History of Geology," pp. 210, 211.


FIG. 17 — FOLDED SHALE FROM HOT SPRINGS, NORTH CAROLINA

large river, with its rocks of many varying "ages," was all elevated practically as it is now before this river began its work of erosion. It treats all these rocks as if they were of the same age, and as if it began sawing at them all at the same time.[2]

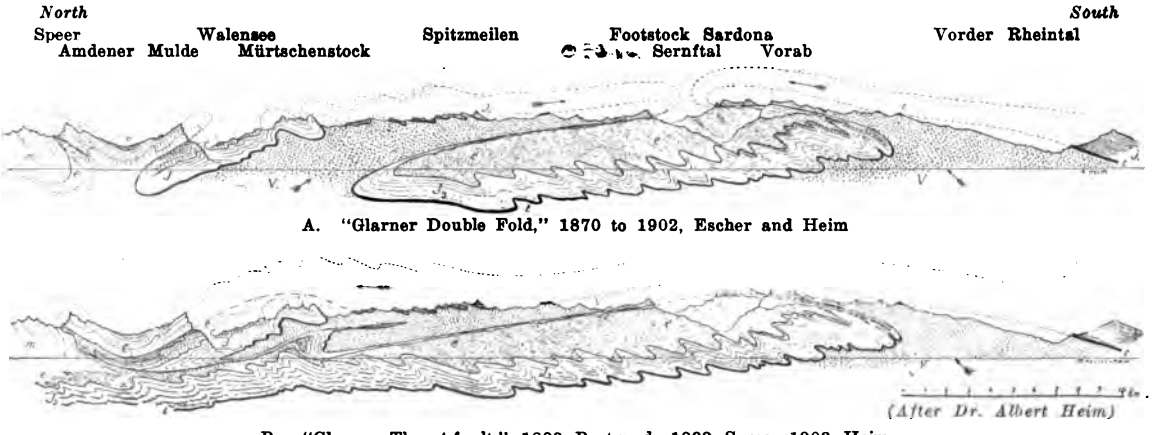
Also its companion, the Green River, cuts through the Uinta Range in the same manner. Similar conditions occur on the Danube, and in the river courses of the Himalayas, and elsewhere.

In the case of the Colorado, Zittel says that "Powell's explanation of the apparent enigma is that, after the river had eroded its channel, rocks were uplifted in one portion of its course, but so slow was the rate of uplift that the river was enabled to deepen its channel, either proportionately or more rapidly, so that it was never diverted from its former course."

It was by similarly cunning inventions that the early writers on astronomy, alchemy, and medicine evaded the force of accumulated facts which told against their absurd theories.

We have now completed our survey of the strictly stratigraphical phases of this question, and have

[2] Practically the same thing might be said of the great breaks or faults in the strata. "They affect the whole mass of rocks in almost every instance where they occur, instead of being limited by the boundaries of particular formations." (George Young, in an address before the British Association, 1838.) But it is more emphatically true of the shore-lines that surround all the continents. They are the same on Archæan, Carboniferous, Cretaceous, or Tertiary coasts indifferently. To quote a few words from Suess: "All the relics of ancient shore-lines of which we have made mention are always horizontal, and absolutely independent of the structure of the coasts, . . . and extend around all coasts and under every latitude in complete independence of the structure of the continents." ("The Face of the Earth," Vol. 2, p. 550.)




A. "Glarner Double Fold," 1870 to 1902, Escher and Heim

B. "Glarner Thrust-fault," 1883 Bertrand, 1892 Suess, 1903 Heim

*m* — Molasse (Middle Tertiary) *C* — Cretaceous *t* — Triassic (Röthidolomit)
*e* — Flysch (Lower Tertiary) *J* — Jurassic *V* — Verrucano (Permian)

FIG. 18 — THE UPSIDE-DOWN CONDITIONS IN GLARUS AS VARIOUSLY EXPLAINED

It is thought by some who are unacquainted with geological methods that there must be real physical evidence on which these theories of thrust-faults and overthrust folds are based. But in this sketch of the rocks as found in Glarus, the most famous of these upside-down conditions, because the best and longest known, we see that what was formerly called a "double fold," with the Jurassic and Triassic rocks folded in from both sides toward the Sernf Valley, is now called a "thrust-fault," with the rocks all pushed one way. And of course it should always be remembered that all the lines in the above diagrams except those in the upper part of the pictures and the actual outcrops *are purely imaginary.* They are merely ideal sketches of what this author thinks must be the conditions underground according to his theory. But the very fact that what was long regarded as two completely overturned folds is now regarded as one flat-lying thrust-fault, is proof positive that there is no physical evidence of a real overturning of the strata. The fossils are here in the wrong order; that is all. And to save the life succession theory, this diagram is given as an attempted explanation. As Dr. Albert Heim once expressed it in a letter to the author, that the strata over immense areas are thus in a position contradicting the current theories, "is a fact which can be clearly seen — *only we know not yet how to explain it in a mechanical way.*"

found four very remarkable principles about the rocks, which I wish to summarize here before proceeding further:

1. The "broad fact," as stated by Zittel and Dana, that any kind of rocks whatever, that is, containing any kinds of fossils, even the "youngest," may rest on the Archæan, and may thus in position, as also in texture and appearance, resemble the very oldest deposits on the globe.

The converse of this is also true, for the very "oldest" rocks may consist of muds "scarcely indurated" and sands "still incoherent."

2. That any kind of beds may rest in such perfect conformability on any other so-called "older" fossiliferous beds over vast stretches of country that, "were it not for fossil evidence, one would naturally suppose that a single formation was being dealt with," while "the vast interval of time intervening is unrepresented either by deposition or erosion." The youngest seem to have followed the oldest in quick succession.

3. That in very many cases and over many hundred square miles of country these conditions are exactly reversed, and such very "ancient" rocks as Cambrian limestones are on top of the comparatively "young" Cretaceous, while the line between them "acts exactly like the line of contact of two nearly horizontal formations," and in a natural section made by a river the two "appear to succeed one another conformably." To any one ignorant of the

FIG. 19 — CANYON OF THE COLORADO RIVER

theory of life succession they have every appearance of having been deposited as we find them.

In short, this and the preceding generalization may be combined into the following comprehensive law, which I shall venture to call the *Law of Conformable Stratigraphical Sequence,* and which is by all odds the most important law that has yet been discovered in connection with this whole subject of stratigraphical geology:

ANY KIND OF FOSSILIFEROUS ROCK MAY OCCUR CONFORMABLY ON ANY OTHER KIND OF FOSSILIFEROUS ROCK, OLD OR YOUNG.[3]

4. That the rivers of the world, in cutting across the country, completely ignore the varying ages of the rocks in the different parts of their courses, and act precisely as if they began sawing at them all at the same time.

Now I know not what additional fact can be demanded or imagined to complete the demonstration that there is *no particular order* in which the fossils can be said to occur as regards succession in time. And since the only shadow of an objective argument ever put forth to defend the life succession has been

[3] In the light of what we have now learned regarding the fundamental methods and processes of geology, how absurd appears the following news item regarding a very estimable lady, whose name need not be given here: "In 18— she accompanied her husband [a prominent geologist] to Newfoundland, where they worked out the key to the Cambrian formations of the North American continent." (*Nature,* August 3, 1911.) With just as much confidence of accuracy A. G. Werner, in his little district of Germany, "worked out the key" to the rocks of all the rest of the world. Thanks to the wide-spread knowledge of the principles of Bacon and Newton, such things can not much longer masquerade in the garb of inductive science.

that the fossils always occur in the same relative order of sequence, we find that this solitary argument is false *in toto*. It is a good deal like the problem proposed by Charles II to the bishops,— why a dead fish increases the weight of a glass of water in which it is contained, while a live fish does not. Considerable learned discussion was expended over the subject, until some one suggested the plan of trying it by actual experiment and seeing if it were really so, with the result, of course, that the whole thing was only another joke of the Merry Monarch. But the geological problem is very similar. For nearly a century the learned world has said that there has been a succession of life on the globe *because* the rocks always occur in a certain relative order of sequence. But in the light of modern discovery it turns out that they don't do anything of the kind. We really find them in every conceivable order of relationship to one another. Hence it is hard to see how this *a priori* doctrine of life succession, so utterly destitute of defense as an abstract idea, and now found to be at variance with a thousand observed facts, will longer be able to hold up its head in the company of the true inductive sciences.

I appeal to my fellow workers in other lines of natural science, not so much to geologists, but to chemists, physicists, and astronomers, to workers in medicine, jurisprudence, and philosophy, whether we do not have here a sufficient amount of unequivocal evidence to call for a complete reconstruction

of the common geological theory of *the order* in which the rocks are to be found. Surely the thousands of persons who are familiar with scientific methods of reasoning as employed in all the other departments of knowledge can not much longer stand patiently by while such a travesty on Baconian methods usurps the place of sensible adherence to proved facts in these fundamental questions of geology. They must soon rise up in their might and say that such a burlesque on inductive methods must cease forthwith.

Of course, in all this I am dealing only with *relative* time. This line of argument is wholly independent of the question of how long it has been since any or all of the geological changes took place. The question of length of time *since* has nothing whatever to do with the logic of the case. This line of argument merely gets us forever rid of the life succession theory as a possible hypothesis; and now, admonished by past mistakes, we must begin over again and reconstruct the science of geology in the light of all that modern science has discovered.

It is true, some fossiliferous deposits, metamorphosed almost beyond recognition, and buried deep beneath thousands of feet of subsequent deposits, have enough appearance of remote antiquity about them in all conscience. But to increase this antiquity by saying that other equally prodigious masses of rocks elsewhere were deposited long after these, or by pointing to still other deposits in another region which are said to be older than any of the others,

is a most illogical and unscientific procedure. I thoroughly sympathize with the attitude of mind that stands dazed at the length of time occupied in any considerable geological event, when considered on the basis of the uniformitarian action of the elements, and without that broad view of the fossil world as a whole that can frame a true induction from the sum of all our ascertained facts. But some other word than "sympathy" is needed to describe my feelings for the mind that can, in the face of the principles here brought out, continue to arrange the rocks off in exact chronological sequence over the whole earth, and treat these successive ages as if they had an objective validity. I fear I might transgress the bounds of parliamentary language were I to attempt to use the appropriate word to describe such a proceeding; for however much indulgence we ought to manifest for a time toward those who have grown up accustomed to the current theories, the time is not far distant when we shall look back upon all these exact chronological distinctions that are now made between the different "horizons" with little else than amusement and pity.

And surely it is scarcely necessary in this enlightened age to point out how completely this vitiates any biological argument (such as that of Darwinism) which has incorporated into its system the results of such illogical reasoning, or which is in any way dependent upon the conclusions of such a theory of geology. In view of the laws of evidence, which every intelligent person is supposed to understand

nowadays, surely some strange things passed for scientific proof during the nineteenth century. For, as we have seen, the earlier geologists did little better than assume the succession of life bodily; then Agassiz and his contemporaries arranged the details and the exact order of these successive life forms by comparison with the embryonic life of the modern individual; and now the evolutionists of our day, led by such men as Fritz Müller, Spencer, and Haeckel, with their "biogenetic principle," prove their theory of evolution by showing that the embryonic life of the modern individual is only "a brief recapitulation, as it were, from memory," of the (assumed) geological succession in time.[4] Surely this will some day make a more amazing record for

[4] This method of arranging in ascending series the geological types of life, and placing alongside these the classification series of living animals, and then correlating with these two purely artificial arrangements the embryonic development of the modern individual as a third parallel series, has always been considered the culminating argument for evolution. But if, in addition to the exposure of the geological series given in the previous pages, we consider (1) how Agassiz, in the early days of geology, soon after the historic discoveries of Von Baer regarding embryology, made use of the embryonic development of each particular group *to determine what ought to be the geological order of the fossils of this group* — a custom which has grown with the passing years until it dominates absolutely this whole field of study; and if, further, we consider (2) how the modern taxonomic classification is continually *rearranged to bring it into more apparent agreement with this embryonic measuring line;* we may begin to appreciate why such men as Carl Vogt, Oskar Hertwig, His, and numerous others, with only a part of the light which we now possess, have discarded this favorite argument of Haeckel regarding biogenesis, just as T. H. Morgan in our own country says that it is *"in principle false."* Whatever may be the real lesson to be learned from the embryonic development, it is most fantastic and circular reasoning to bring it in as argument for evolution, considering the way in which it has been used to build up the geological series.

posterity than those of phlogiston or the epicycles of Ptolemy.

If it is now asked, What do the rocks have to tell us, in view of the fact that they refuse to testify to a life succession? I can only say that we are not as yet in a position to decide this question. There are several other matters connected with the character and mode of occurrence of the fossils, which are almost equally important with anything already considered, in forming a true scientific induction regarding this matter. These facts must be considered in subsequent chapters. Already, however, we can say this much,— that we have in the rocks almost as complete a world, in some respects vastly more complete, than the living world of to-day. With the life succession theory repudiated, we have still to deal with the fossils themselves which have been thus systematically classified; but this geological series becomes only the taxonomic or classification series of an older state of our present world, buried somehow and at some time or times in the remote past — the how and the when of which we have not at this stage of the argument the means to determine.

But I think we are now prepared to enter the mazes of the biological argument, and to study the subject of extinct species, which by many is supposed to furnish a line of independent evidence in favor of the life succession theory.

# CHAPTER VII

## Extinct Species

LET us now test the value of this assumed life succession by another very simple question. In "Eocene times," so we are told, England was a land of palms, with a semitropical flora and fauna. In fact at this time, Cycads, Gourds, Proteads (like the Australian shrubs and trees), the Fig, Cinnamon, Screw-pine, and various species of Acacias and Palms, abounded in England and Western Europe. Then again, in the Pleistocene deposits of the same countries, we find various species of Elephant and Rhinoceros, with a Hippopotamus, Lion, and Hyena, identical with species now living in the tropics.

*Now, how are we to prove that these various Pleistocene animals did not exist together in these countries at the same time as the Eocene trees and plants before mentioned?*

Lions and Monkeys, Hippopotami and Crocodiles, with Elephants, Hyenas, and Rhinoceroses, now live beneath the Palms, Mimosas, Acacias, and other tropical plants represented in the Eocene and Miocene beds. What is there to hinder us from believing that they all lived there together in that olden time? Surely it would be the very irony of scientific fate if forms now so closely connected in life

should in death be so divided. Or, to present it in another form, Why should we be asked to believe that these Acacias, Cinnamons, Palms, etc., lived and died ages or millions of years before the Lions, Elephants, Rhinoceroses, and Hippopotami came into existence to enjoy their shade; and then, after these unnumbered ages had dragged their slow length along and vanished into the dim past, and all these semi-tropical plants had shifted to the tropics or been turned into lignite, these Lions, Elephants, and Hippopotami came into existence in these same localities, when no such plants existed anywhere in Europe?

Surely we ought to expect some pretty substantial evidence for such a violation of our universal modern experience. We generally boast that we have outgrown the crude ideas of the earlier years of the science, when they spoke of "ages" of limestone making or of sandstone making; but it seems that some of us have not yet attained to that broad view of the essential solidarity of nature in which the flora and fauna of our world are seen to be just as indissolubly connected with each other. But nature could as easily be persuaded to produce for a whole age nothing in the way of rock but limestone or conglomerate, as to adjust her powers to such an unbalanced state of affairs as is spoken of above, with the animals in one age and the complementary plants in another.

But in considering this question as to why the Eocene plants and the Pleistocene animals may not be supposed to have lived contemporaneously to-

gether, we are brought face to face with the *second* supposed argument in favor of there having been a succession of life on the globe. The answer given is that all the animals of these "early" Tertiary beds are extinct species, also very many of the plants; while the Hyena, Lion, Hippopotamus, etc., of the Pleistocene are identical with the living species, and even the Mammoth is so closely like its nearest surviving relative, the Asiatic Elephant (*E. indicus*), that these also might be classed as identical.[1]

This point being considered by many as so important, and having such a vital connection with the whole life succession theory, we must go into the matter somewhat in detail, even at the risk of appearing rather technical to some.

If the Palæozoic and Mesozoic strata are often of enormous extent, spreading in vast sheets over wide regions, so that their stratigraphical order in any particular district is quite readily made out, it is in most cases altogether different with the Tertiary and Pleistocene deposits. For these resemble one another so much in everything except their fossils, and occur so generally in detached and fragmentary beds, holding no stratigraphical relation to one another, that Lyell devised the plausible plan of distinguishing them from one another and arranging them in the accustomed order of successive ages, by their relative percentages of living and extinct Mollusca. With only unimportant changes, Lyell's divisions are still followed in classifying the Tertiary

[1] See p. 138 of this volume.

and Post-Tertiary beds. Those with *all* the species extinct, or less than five per cent living, are classed as Eocene; those containing *few* extinct forms, or nearly all living species, are classed as Pleistocene or Post-Tertiary. The Miocene and Pliocene represent the intermediate grades, and all are supposed to be a true chronological order. It goes without saying that in actual practise it is often so extremely difficult to adjust these differences that beds are assigned to an "early" or a "late" division on general principles by what the literary critics would call "tact" or "intuition," rather than by the strict percentage system, though for these large and important divisions of Tertiary and Post-Tertiary rocks, these are absolutely the only professed grounds on which the subdivisions are distinguished and arranged in the customary order of time.

In the words of Dr. David Page:

> As there is often no perceptible mineral distinction between many clays, sands, and gravels, it is only by their imbedded fossils that geologists can determine their Tertiary or Post-Tertiary character.—"*Intro. Text-Book,*" *p. 189.*

Now to say that a set of beds, ninety-five per cent of whose fossils belong to extinct species, and only five per cent are now living, must be vastly older than another set where these percentages are reversed — that is, where the species are nearly all living — seems at first thought an eminently reasonable idea, and we immediately begin to imagine the long ages it must have taken for these exceedingly numerous and apparently vigorous species to wear

out and become extinct in the alleged ordinary way by the merciless struggle for existence with forms more fitted to survive.

But it is hardly necessary to point out that all this is based on the assumption of *uniformity* in its most extreme type, a doctrine which not only denies that these living forms are merely the *lucky survivors* of tremendous changes in which their contemporaries perished, but which in essence is taking for granted beforehand the very point which ought to be the chief aim of all geological inquiry, namely, How DID THE GEOLOGICAL CHANGES TAKE PLACE? It would not be considered a very scientific procedure for a coroner, called upon to hold a *post-mortem,* to content himself with interesting statistics about the percentage of people who die of old age, fever, and other causes, while there was clear and decisive evidence that the poor fellow under examination had been *shot.* In this case, as in geology, it is not merely the result that is wrong, but the whole method of investigation. For, as in the latter case we don't want to know how people generally die, but how this particular person actually did die, so, in our study of geology, we do not wish to know merely the rate at which changes of surface and extinctions of species are now going on, and then project this measure backward into the past as an infallible guide, but we wish to know for sure just what changes of this nature have taken place. A true induction is, I think, capable of deciding very positively whether or not the tools of nature have always worked at the same

rate and with the same force as at present; and this method of arranging the fossils in supposed chronological order on the percentage basis mentioned above, is only an extreme form of methods claiming to be inductive which in this age of the world ought to be considered a shame and a disgrace, because, as Howorth says, they are based, "not upon induction, but upon hypotheses," and have "all the infirmity of the science of the Middle Ages."

Then again, it occurs to us that this method, of attaching a time value to percentages of extinct or living species, would make the subfossil remains of the Bison on the Western prairies almost infinitely *older* than those of the Lion, Hippopotamus, etc., in the Pleistocene beds of Europe; for (except for some few specimens artificially preserved, and which may be neglected in this connection) the Bison is to-day practically extinct, while the Pleistocene Mammals are found by the thousand in the proper localities, and show no signs of surrender in the struggle for existence. Similar comparisons might be made between the great wingless Birds of Madagascar, Mauritius, and New Zealand, and the many cases of "persistent" forms of Invertebrates which have survived unchanged from Carboniferous, Silurian, or Cambrian times, a period of time which, in the language of the current geology, means quite a large fraction of eternity. But all these considerations show that the mere fact of certain species being extinct and others being now alive, is no trustworthy guide in determining the relative age of their remains,

until we *first find out how they happened to become extinct.*

The inquiry as to the how and the when (relatively) is an absolutely essential preliminary in any such investigation, and is inseparably united in nature with the general question of how the great geological changes have taken place in the past. Of course, if everything like a world catastrophe is *a priori* denied; if, in other words, it is settled from the first that all these fossils living and extinct *did not live contemporaneously* with each other, the living ones being simply the lucky survivors of stupendous changes in which the others perished,— then all pretense of a scientific investigation of the subject is at an end. If a coroner has it settled beforehand that an accident or a murder could not possibly have occurred, then his profession of a candid *post-mortem* examination is only a farce; for he does not hold it to find out anything, since he knows everything essential about it beforehand. Uniformitarians would certainly make poor coroners, or for that matter poor investigators of law, or history, or anything else.

Will some one please give us a reasonable explanation of why the Lion, Hippopotamus, Rhinoceros, and Elephant shifted from England to the tropics? Or will they explain how, at this same general time, some Elephants and Rhinoceroses got caught in the merciless frosts of Northern Siberia so suddenly that their flesh has remained untainted all these centuries, and is now, wherever exposed, greedily devoured by the Dogs and Wolves?

An abundant warm-climate vegetation once mantled all the polar regions, and its fossils have been found just about as far north as explorers have ever gone; while Dana says that "the encasing in ice of huge Elephants, and the perfect preservation of the flesh, shows that the cold finally became *suddenly* extreme, as of a single winter's night, and knew no relenting afterwards."[2] ("Manual," p. 1007.)

Now, if no one can deny this *sudden* change of climate over half the world or so at least, is it not extremely unscientific to deny that this same cause, whatever it may have been, was quite competent to bring about a good many other changes, and the extinction of numerous other species, which we are so often reminded must imply the lapse of untold ages of time? The economizing of energy, or the famous law of parsimony, as stated by Leibnitz, is quite appropriate in this case, and may be referred to again in the sequel. The principle upon which I must here insist is that the mere fact of certain species being extinct, and others being now alive, gives no clue whatever to the relative age of these remains, until we first ascertain why, how, and when this extinction was brought about. And yet, though every one admits the fact of tremendous changes of climate, etc., having intervened between that ancient world and our own (the true extent and character of which, as I have said, ought to be the chief point of all geological investigation), no allowance seems ever

[2] Professor Dana has italicized the word "*suddenly.*"

to be made for this as a powerful cause of extermination of all forms of life. *On what grounds can our science discriminate among these extinct species, and fix on only a limited few of them that were made extinct by this event, and then arrange the others off on the percentage system, as if such a catastrophe had never happened?*

But in the utter absence of any such explanation as to *how* and *when,* and assuming in the very teeth of these facts a dead-level uniformitarianism, the presence of ten, fifty, or a hundred per cent of extinct forms in a set of beds is manifestly of no scientific value in determining age. It would be many degrees more reasonable and accurate to arrange all the Greek and Latin books of the world in chronological order according to the percentage of their words which have survived into the English language. Indeed, it would be much like a coroner at the inquest following a railway disaster, attempting to arrange the exact order in which the various victims had perished, by the proportionate number of surviving relatives which each had left behind him.

Such methods in any other line of research would soon make their advocates the laughing-stock of the world. The reason why they do not meet this result in the case of geology is that these methods have been in vogue so long, and are sanctioned by the prestige of such illustrious historic names, that they exercise a browbeating, hypnotic spell over all the younger students of the science.

And the completely worthless character of such

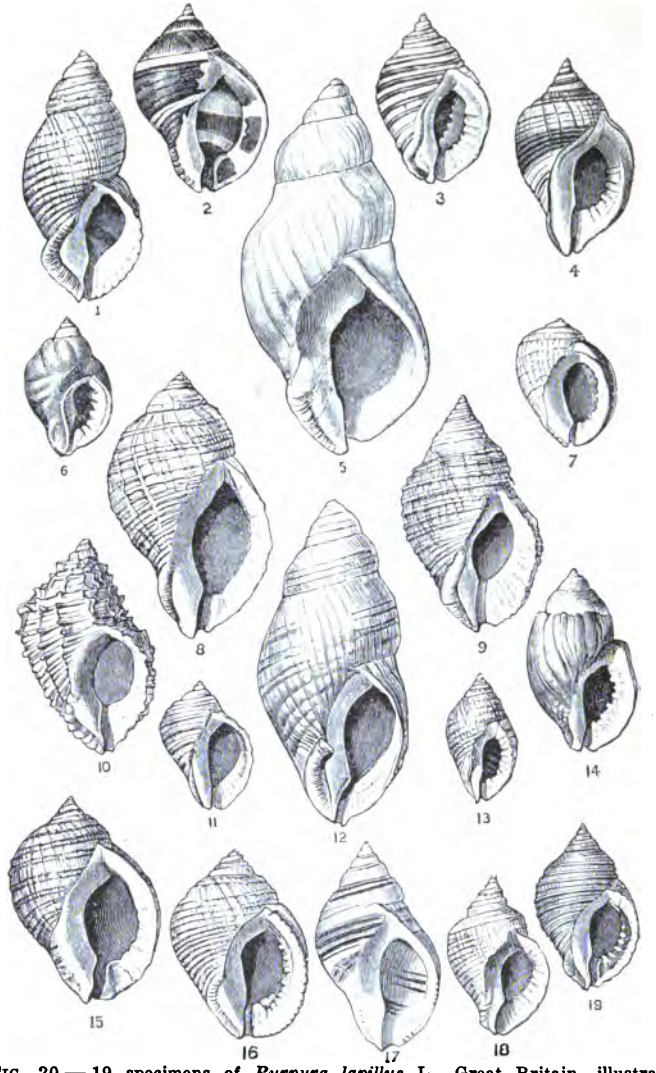



FIG. 20 — 19 specimens of *Purpura lapillus* L., Great Britain, illustrating variation. 1, Felixstowe, sheltered coast; 2, 3, Newquay, on veined and colored rock; 4, Herm, rather exposed; 5, Solent, very sheltered; 6, Land's End, exposed rocks, small food supply; 7, Scilly, exposed rocks, fair food supply; 8, St. Leonard's, flat mussel beds at extreme low water; 9, Robin Hood's Bay, sheltered under boulders, good food supply; 10, Rhoscollyn, on oyster bed, 4 to 7 fathoms (Macandrew); 11, Guernsey, rather exposed rocks; 12, Estuary of Conway, very sheltered, abundant food supply; 13, 14, Robin Hood's Bay, very exposed rocks, poor food supply; 14, slightly monstrous; 15, 16, 17, Morthoe, rather exposed rocks, but abundant food supply; 18, St. Bride's Bay; 19, L. Swilly, sheltered, but small food supply. (After Cooke, in Cambridge Natural History.)

"evidence" of age becomes, if possible, more apparent when we consider that very many of these so-called "extinct" forms are not really distinct species from their living representatives of to-day. "It is notorious," says Darwin, "on what excessively slight differences many palæontologists have founded their species." And even to-day, in spite of all that we have learned about variation, little or no allowance seems ever to be made for the effects of a greatly changed environment. (Fig. 20.) If the fossil forms among the Mollusks and other shellfish, for instance, are not precisely like the modern ones in every respect, they are always classed as separate species, the older forms thus being "extinct," in utter disregard of the striking anatomical differences between the huge Pleistocene Mammals and their dwarfish descendants of to-day, which for a hundred years or so were declared positively to be distinct from one another, but are now acknowledged to be identical.

Of course no one denies that there are numerous extinct forms among the Invertebrates, just as we know there are among the huge Vertebrates of the Mesozoic and Tertiaries, none of which we moderns have ever seen alive. Other forms do not appear familiar to our modern eyes, because larger or of somewhat different form; but to say that they are really distinct species from their modern representatives, or to say that no human being ever saw them alive — that is, that they were not contemporary with Man — is to make statements utterly incapable

of proof. Up to about the year 1869 it was stoutly maintained that man had never seen *any* of these fossil forms in life. But no one now maintains this view, for human remains have since been found along with undisturbed fossils of the Pleistocene, or even middle Tertiaries, while the paintings on the cave walls of Southern France seem conclusive that they were copied from life when the Mammoth and Reindeer lived side by side with Man in that latitude. Hence the only question now is — and it is the supreme question of all modern geology — WITH HOW MUCH OF THAT ANCIENT FOSSIL WORLD WERE THESE EQUALLY FOSSIL MEN ACQUAINTED? If Man lived in "Pliocene" or perhaps "Miocene times," when a luxuriant vegetation was spread out over all the Arctic regions, what possible evidence is there to show that his companions, the Rhinoceros, Hippopotamus, Mammoth, etc., were not also living then and browsing off just such plants, when the Arctic frosts caught them in the grip of death, and put their "mummies" in cold storage for our astonishment and scientific information? Things which are equal to the same thing are equal to each other; why should not the plants and animals contemporary with the same creature, Man, be just as truly contemporary with one another? If Man was contemporary with the Miocene plants, and the Pleistocene Mammals were contemporary with Man, what is there to forbid the idea that the Pleistocene Mammals and the middle Tertiary flora were contemporary with each other?

For nearly half a century geologists have never had the courage to face this problem fairly and squarely, with all preconceived prejudices about uniformity cast aside. Is it possible that all the plants and animals of the Tertiaries and the Pleistocene really may have lived together in the same world after all? But the trouble would then be that, with this much conceded, the whole "phylogenic series" would tumble with it, and become only the taxonomic or classification series of that ancient world with which these fossil men were acquainted. For if no single kind of fossil can be proved to be intrinsically older than other kinds, and Man is found fossil as truly as any other form of plant or animal, how are we to escape the conclusion that this whole fossil world was a unit, and that these fossil men were contemporary with one type of life as truly as with another, or, in other words, contemporary with all alike? To appropriate the words of one who has done much to clear the ground for a common-sense study of geology, I know of nothing against such an idea save "the almost pathetic devotion of a large school of thinkers to the religion founded by Hutton, whose high priest was Lyell, and which in essence is based on *a priori* arguments like those which dominated medieval scholasticism and made it so barren." (Howorth, "The Glacial Nightmare and the Flood," Preface, pages 20, 21.)

Baron Cuvier's work in the line of comparative osteology has never been surpassed, perhaps never equaled since, and he is said to have been "the great-

est naturalist and comparative anatomist of that, or perhaps of any time" (Le Conte, "Evolution and Religious Thought," pp. 33, 34); and yet he maintained till the last that all those which we now call the Pleistocene Mammals were distinct species from the modern ones, and it is only of recent years and with extreme reluctance that many of them have been admitted to be identical with the ones now living. All of which tends to show how unreliable are those assertions commonly found in the text-books about all the "species" of the so-called "older" rocks being extinct. It is only with hesitation that such specific distinctions are surrendered even to-day, though during the last few decades a steady progress has been made in bringing the palæontology of the higher Vertebrates into line with our increased knowledge of zoology, thus breaking down many of the specific distinctions which have long been maintained between the fossil and the living forms. Even the Mammoth has been found to have so many characters identical with the modern Elephant of India, and so complete a gradation exists between the two types, that Flower and Lydekker acknowledge the transition from one to the other is "almost imperceptible," and express a doubt whether they "can be specifically distinguished" from one another. ("Mammals, Living and Extinct," pp. 428, 429.)

But the extreme reluctance with which anything like a confession of this fact leaks out in our modern literature can be readily understood when we try the hopeless task of splicing the environment of the

modern Elephant with that of the ancient on any basis of uniformity.

Zittel gives us a peep behind the scenes which helps us to appreciate the value of a percentage of "extinct" species as a test of the age of a rock deposit.

He pictures the uncritical work of the earlier writers on fossil botany, until August Schink (1868-91) made a great reform in this science; and Zittel declares that "now the author of a paper on any department" of fossil botany "is expected to have a sound knowledge" of the systematic botany of recent forms. But he adds, "It can not be said that palæozoology [the science of fossil animals] has yet arrived at this desirable standpoint."

But he justifies this charge of want of confidence by saying:

> Comparatively few individuals have such a thorough grasp of zoological and geological knowledge as to enable them to treat palæontological researches worthily, and there has accumulated a dead weight of stratigraphical-palæontological literature wherein the fossil remains of animals are named and pigeonholed solely as an additional ticket of the age of a rock deposit, with a wilful disregard of the much more difficult problem of their relationships in the long chain of existence.
>
> The terminology which has been introduced in the innumerable monographs of special fossil faunas in the majority of cases makes only the slenderest pretext of any connection with recent systematic zoology; if there is a difficulty, then stratigraphical arguments are made the basis of a solution. [That is, distinct specific or even distinct generic names are given to the fossils.] Zoological students are, as a rule, too actively engaged and keenly interested in building up new observations to attempt to spell through

the arbitrary palæontological conclusions arrived at by many stratigraphers, or to revise their labors from a zoological point of view.[3]—"*History of Geology,*" *pp. 375, 376.*

Doubtless this scathing impeachment of the common mania for creating new names for the fossils has especial reference to the case of the lower forms of life. For if, in spite of the brilliant and withal careful work of Cuvier, Owen, Wallace, Huxley, Ray Lankester, and Leith Adams, with numerous others that might be mentioned, there are still grounds for such grave doubts of the values of specific distinctions in the case of the Mammals, whose general anatomy and life history are so well known and their almost countless variations so well studied out, what must be the confusion and inaccuracy in the case of the lower Vertebrates, and especially of the Invertebrates, whose general life history in so many instances is so dimly understood, and the limits of their variations absolutely unknown? (See Figs. 20, 21.) Remembering all this, what is our amazement when we read in this same volume by Professor Zittel

[3] In the case of living forms, this mania for multiplying new specific names has met with many a sharp rebuke from our best scientists, and it is a great pity that the same rational view of the matter is not consistently extended backward through the whole long line of the fossil forms. Thus David Starr Jordan gives us a picture of what a battle it has been to keep the list of Fishes from multiplying unduly: "In our fresh water Fishes each species on an average has been described as *new* from three to four times, on account of minor variations, real or supposed. In Europe, where Fishes have been studied longer and by more different men, upwards of six or eight nominal species have been described for each one that is now considered distinct." ("Science Sketches," p. 99.) And again, "Thus the common Channel Cat-fish of our rivers has been described as a *new species* not less than twenty-five times, on account of differences real or imaginary, but comparatively trifling in value." (*Id.*, p. 96.)

(pp. 400, 403, 405) that the tendency among many modern writers in dealing with these lower forms of life, is toward the erection of the closest possible distinctions between genera and species, until recent palæontological literature is fairly inundated with new names; and all this with *the purpose,* unblushingly avowed, of "enhancing the value" of such distinctions *as a means of determining the relative ages of strata,* and to "bring the ontogenetic and phylogenetic development" of the various forms "into more *apparent* correspondence." I do not exaggerate in the least, as the reader may see by referring to Zittel's book; though not wishing to make my readers "spell through" another quite technical paragraph, I have refrained from a lengthy quotation.[4]

But surely we have here a most amazing style of reasoning. It is another clear case of first assuming one's premises, and then proving them by means of one's conclusion. The method here employed seems about like this: First assume the succession of life from the low to the high as a whole; then in any particular group, as of Brachiopods or Mollusks, decide the momentous question as to which came first and which later in "geological time" by comparing them as to size, shape, etc., with the live modern individual in its development from the egg

[4] The following regarding Rafinesque, an early naturalist of the Eastern States, is too delicious to be omitted in this connection, as we can see that many modern zoologists and botanists are still somewhat Rafin*esque* in their methods: "He once sent for publication a paper seriously describing, in regular natural history style, twelve new species of thunder and lightning which he had observed near the Falls of the Ohio." (David Starr Jordan, "Science Sketches," p. 165.)

to maturity; and lastly, take the results of this alleged chronological arrangement to prove just how the modern forms have evolved. It is a most striking example of how otherwise intelligent men may be

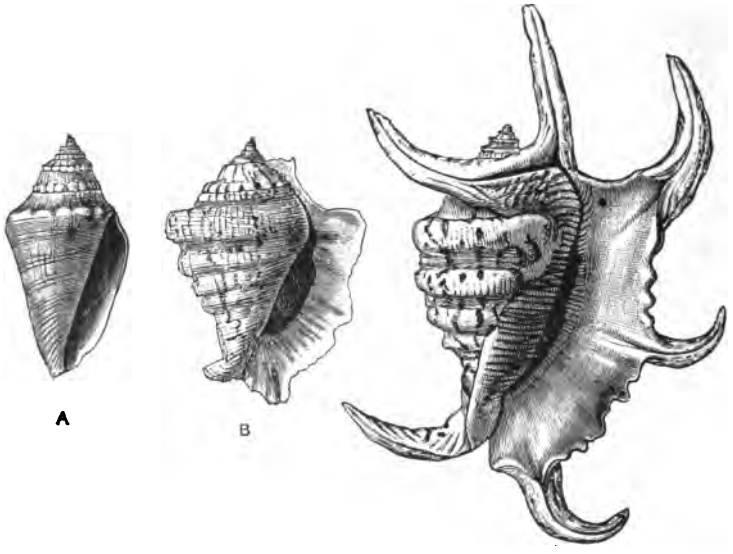



FIG. 21 — Three stages in the growth of *Pteroceras rugosum* Sowb., East Indies, showing the development of the "fingers." (After A. H. Cooke, in Cambridge Natural History.) If these were found fossil, how natural it would be to place them not merely in separate species, but in distinct genera!

hypnotized by a theory into blind obedience to its suggestions and necessities.

Not long ago I had occasion to write to a friend, a well-known geologist, about a Lower Cambrian Mollusk which appears strikingly like a modern species. I give below an extract from his reply which bears directly upon this point. I withhold

the name, but I may say that the author's work on the Palæozoic fossils is recognized on both sides of the Atlantic.

Some geologists make it a point to *give a new name* to all forms found in the Palæozoic rocks; that is, a name different from those of modern species. I was taken to task by a noted palæontologist for finding a Pupa [a kind of land snail] in Devonian beds; but I could not find any point in which it differed from the modern genus.

Of about the same import are the following remarks by Angelo Heilprin: "It is practically certain that numerous forms of life, exhibiting no distinct characters of their own, are constituted into distinct species for no other reason than that they occur in formations widely separated from those holding their nearest kin." The real reason at the bottom of such a proceeding, he freely confesses, "is based upon the assumption that no species, after it once became extinct, ever again came into existence." Hence, when a seemingly identical species reappears in a widely separated formation, or is found alive in the modern world, a new name is always given it, to avoid the difficulty of having it skip all the intervening ages. He clearly indicates that such things ought not to be done, and that similar forms, wherever found, ought to be classed together as the same species, no matter if it does involve the absurdity of these species skipping long sections of the geological series. He gives a large number of examples of such skipping among the Invertebrates; but doubtless even he, expert conchologist though he is, became discouraged in

attempting to "spell through" the flood of new names referred to by Zittel, for he concludes by the remark:

*It is by no means improbable that many of the older genera, now recognized as distinct by reason of our imperfect knowledge concerning their true relationships, have in reality representatives living in the modern seas.—"The Geographical and Geological Distribution of Animals," pp. 103, 104, 207, 208.*

Such disclosures speak volumes for those able to understand, and lead one to receive with a smile the familiar assertion that all the species of the Palæozoic and other "older" rocks are extinct. And we can now form a truer estimate of the high scientific accuracy of Lyell's ingenious division of the Tertiary beds, according to the percentage of living or "extinct" Mollusks which they contain.

But from the inherent weakness of the argument about extinct species as thus revealed, it follows that chronological distinctions based on any proportionate number of extinct species have absolutely no scientific value; and hence that the life succession theory finds no support from these distinctions between "extinct" and "living" species, just as we have already seen that it is without a vestige of support from the stratigraphical argument.

The life succession theory has not a single fact to confirm it in the realm of nature. It is not the result of scientific research, but purely the product of the imagination, and an imagination ignorant of a thousand facts that are now matters of common knowledge.

# CHAPTER VIII

## Skipping; Fact Number Five

We have now to deal with another absurdity involved in the life succession theory, the discussion of which grows naturally out of the subject of extinct species.

As preliminary to the subject here to be presented, we must bear in mind that the present arrangement of the fossils in alleged chronological order, as well as the naming of thousands of typical specimens, was all well advanced while as yet little or nothing was known of the contents of the depths of the ocean, or even of the land forms of Africa, Australia, and other foreign countries. In most of the important groups of both plants and animals, the detailed knowledge of the fossil forms *preceded the knowledge of the corresponding living forms,* just as Zittel says that the theories of the igneous origin of the crystalline rocks "had been laid without the assistance of chemistry" and the knowledge of the microscopic structure of these rocks.[1] On pages 128-137 of his "History," this author shows how, up to 1820, little or nothing of a scientific character was known of any of the classes of living animals save Mammals, while the geological series was all

[1] "History," pp. 327, 341.

fixed long before this date.[2] During the last half-century, however, the progress of science has been steadily showing case after case where families and genera, long boldly said to have been "extinct" since "Palæozoic time," are found in thriving abundance and in little altered condition in unsuspected places all over the world. And the point for consideration here is the manifest absurdity of these inhabitants of the modern seas and the modern land *skipping* all the uncounted millions of years from "Palæozoic times" down to the "recent"; for though found in profuse abundance in these "older" rocks, not a trace of many of them is to be found in all the "subsequent" deposits.

The proposition here to be considered and proved I shall venture to formulate as follows:

*There is a fossil world and there is a modern living world, the two resembling one another in various details as well as in a general way; but to get the ancestral representatives of many modern types, for example, countless Invertebrates, with other lower forms of animals and plants, we must go clear back to the Mesozoic or the Palæozoic rocks, for they are not found in any of the "more recent" deposits.*

I have already remarked that the blending of the doctrine of life succession with that of uniformity, must inevitably have given birth to the evolution theory, for it is evident that the succession from the

[2] Compte, in his classification of the sciences, issued in 1820, denied a place to geology altogether, because, he said, it was not a distinct science at all, but only a field for the application of the sciences.

low to the high could only have taken place by each type blending with those before and those after it in the alleged order of time. That such is *not* the testimony of the rocks, even when arranged with this idea in view, is too notorious to need any words of mine, for it has been considered by many[3] the "greatest of all objections" to the theory of evolution.[4]

This abruptness in the disappearance of "old" and the first appearance of "new" forms, has brought into being that "geological scapegoat," as James Geikie has called the doctrine of the imperfection of the record. But Dawson has well disposed of this argument in the following words:

> When we find abundance of examples of the young and old of many fossil species, and can trace them through their ordinary embryonic development, why should we not find examples of the links which bound the species together? — *"Modern Ideas of Evolution," p. 35.*

But it is equally evident that each successive formation of the series ought to contain, in addition to its own characteristic or "new" species, *all the older forms which survived into any later deposits, or are now to be found living in our modern world.* Such no doubt was the idea of those of the early geological

[3] See Le Conte, "Evolution and Religious Thought," p. 253. Note also the following from Charles Darwin himself: "Geology assuredly does not reveal any such finely graduated organic chain; and this, perhaps, is the most obvious and gravest objection which can be urged against my theory." ("Origin of Species," p. 342, 1859.)

[4] This fact is not only an argument against evolution, but its chief weight lies against the current geological theory of successive ages. Yet it has been so often mentioned in writings on this subject that it seems unnecessary to do more than refer to it here.

explorers who discarded Werner's onion-coat theory, and they tried to arrange their series accordingly. This reasonable demand is still recognized as good; and the principle is alluded to by Dana when he attempts to show how strata might be discovered and "proved" to be older than the present Lower Cambrian rocks.[5]

It is, I say, still recognized *in theory* that the "younger" deposits ought to contain samples of the "older" types which were still surviving, in addition to their own characteristic species; but with the progress of geological discovery it has long since been found that such an arrangement is utterly impossible. Indeed, it would almost seem as if modern writers had forgotten the principle altogether.

For there are mȧny kinds of Invertebrates, both terrestrial and marine, alive in comparative abundance in our modern world, whose fossils are found only in some of the very oldest rocks, and have skipped all the rest! Others which date from "Mesozoic times" are wholly absent from the Tertiary rocks, though found abundantly in our modern world. This I regard as another very crucial test of the rationality of this idea of a life succession.

Of course there are certain limitations which must be borne in mind. If we find a series of beds made up largely of deep sea deposits, we can not reasonably expect to find in them examples of all the land forms of the preceding "ages" which then survived, nor even of the shallow water types. Nor, conversely,

[5] See "Manual," pp. 487, 488.

can we demand that, in beds crowded with the remains of the great Mammals and plants, and thus probably of fresh or shallow water formation, we ought to find examples of all the marine types still surviving. We now know that each level of ocean depth has its characteristic types of life, just as do the different heights on a mountainside. This doctrine of "rock facies" was, I believe, enunciated first in 1838. Edward Forbes also did much for this same idea, showing how at the present time certain faunas are confined to definite geographical limits and particular ocean depths. Jules Marcou about 1848 applied this principle to the fossils, and showed how such distinctions must have prevailed during geological time.

Here it seems that we are at last getting a refreshing breath of true science; but if carried out in its entirety, how shall we assure ourselves that in the long ago very diverse types of fossils, for example, Graptolites and Nummulites, or even Trilobites and Mammals, *could not have been contemporary with each other?* This principle of "rock facies," if incorporated into the science in its early days, would have saved the world from a large share of the nonsense in our modern geological and zoological text-books.

But in answer to any pleadings about the imperfection of the record, or any protests about the injustice of judging all the life forms of an "age" by a few examples of local character — that is, of fresh, shallow, or deep water, as the case may be — the very

obvious retort is, *Why then is a time value given to such local and fragmentary records?* Why, for example, should the Carboniferous and associated formations be counted as representing *all* the deposits made in a certain age of the world, when we know from the Cambrian and Silurian and also from the alleged "subsequent" Jurassic that there must have been vast open sea deposits formed contemporaneously?

As Dana expresses it:

> The Lias and Oolyte of Britain and Europe afforded the first full display of the marine fauna of the world since the era of the Subcarboniferous. Very partial exhibits were made by the few marine beds of the Coal-measures, still less by the beds of the Permian, and far less by the Triassic. The seas had not been depopulated. The occurrence of over 4,000 Invertebrate species in Britain in the single Jurassic period is evidence, not of deficient life for the eras preceding, but of extremely deficient records.—*"Manual," p. 776.*

Surely these words exhibit the "phylogenic series" in all its native, unscientific deformity. It is *because* the Coal-measures, the Permian, and the Triassic, are necessarily "extremely deficient records" of the total life forms then in the world, that I am writing this chapter, and this book. But it seems like perverseness to plead about the imperfection of the record, and yet refuse the *evidently complementary deposits* when they are presented. If, as this illustrious author says, "the seas had not been depopulated," what would he have us think they were doing? Were they forming no deposits all these intervening ages that the Carboniferous,

Permian, and Triassic were piling up? Were the Fishes and Invertebrates all immortalized for these ages, or were they, when old and full of days, translated to some supermundane sphere, thus escaping deposit in the rocks? Did the elements continue in the *status quo* all these uncounted millions of years? And if so, how did they receive notice that the Triassic period was at last ended, and that it was time for them to begin work again? I do not like to appear trivial; but these questions serve to expose the folly of taking diverse, *local,* and *partial* deposits, and attaching a chronological value to each of them separately, and then pleading in a piteous, helpless way about the imperfection of the record.

And yet I can not promise to present a tithe of the possible evidence, because of two serious handicaps. First, the ordinary literature of palæontology is silent and meager enough in all conscience, even though the bare fact may be recorded that a "genus" of the Cambrian or Silurian is "closely allied" to some genus now living. It may be even admitted that "according to some it is not generically distinct from the modern genus" so-and-so; but the authors never descend below the "genus," and in most cases forget to tell us whether or not it occurs in other "later" formations, though of course the presumption is that it does not, but has skipped all the intervening ages, or it would hardly be named as a characteristic type of the formation in which it occurs.

But this disadvantage, serious though it be, is

scarcely worth speaking of when we remember that "some geologists make it a point to give a new name to all forms found in the Palæozoic rocks"; or as Heilprin says, "It is by no means improbable that many of the older genera, now recognized as distinct by reason of our imperfect knowledge concerning their true relationships, have in reality representatives living in the modern seas." ("Geographical and Geological Distribution," pp. 207, 208.)

Hence I have no reluctance in saying that, in the present confused state of zoology and palæontology, it is utterly impossible for any one to find out the truth as to how many hundreds of these "genera" of the Palæozoic rocks may have survived to the present, though having skipped perhaps all the formations of the intervening millions of years. I doubt not that the number is enormously large, though as no one has yet attempted "to spell through the arbitrary palæontological conclusions" scattered through the literature, we can depend on only a few though striking examples that lie on the open pages of the ordinary text-books.

The larger Mammals can of course furnish us no examples, for the "age" in which they abounded is quite conveniently modern, and is separated from the present by no great lapse of time. Of the smaller Marsupials quite a number of jaw-bones have been found in the Jurassic and Triassic, one from the latter being strikingly like the living *Myrmecobius* of Australia. They are scarcely more numerous in the Cretaceous of America, while in the foreign

rocks of this system Dana says that "only one species had been reported up to 1894." Those strange, sad-eyed creatures called Lemurs deserve a passing notice, for though now confined as to their typical forms to the island of Madagascar, their fossils seem as exclusively confined to the temperate regions of the New and the Old World. Flower and Lydekker enumerate about fifteen fossil species, and add that "it is very noteworthy that all these types seem to have disappeared from both regions with the close

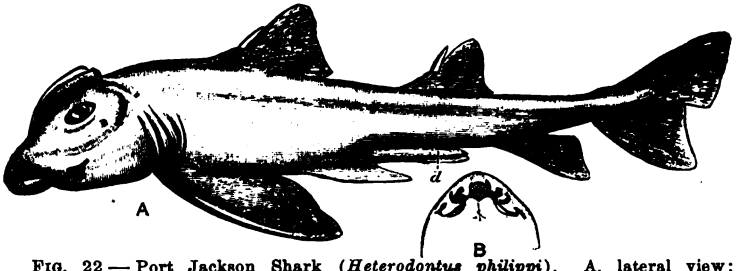



FIG. 22 — Port Jackson Shark (*Heterodontus philippi*). A, lateral view; B, mouth and nostrils. *d*, Clasper. (From a specimen in the Cambridge University Museum, after T. W. Bridge.)

of the upper portion of the Eocene period." ("Mammals," etc., p. 696.)

But this jump from the "Eocene period" to the present is as nothing compared with the secular acrobatics of some of the Fishes and especially of the Invertebrates. The living Heterodont or Bullhead Sharks (among which is the Port Jackson Shark, Fig. 22), of which there are four species found in the seas between Japan and Australia, seem to disappear with the Cretaceous, skipping the whole Tertiary epoch, as do also a tribe of modern Barnacles

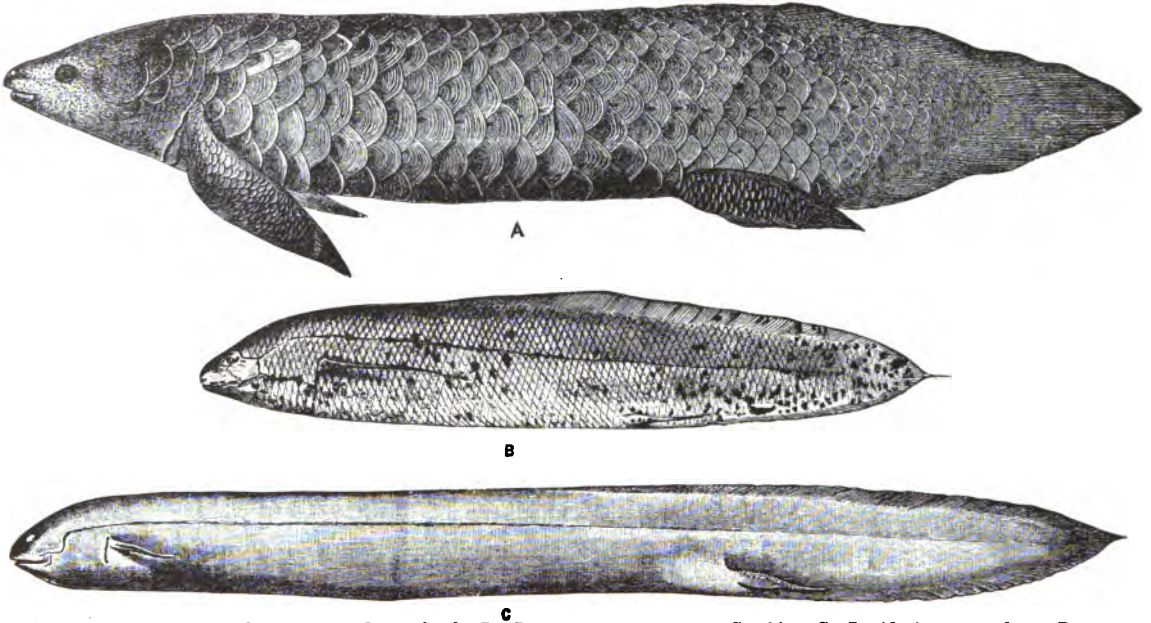



FIG. 23 — A, *Neoceratodus forsteri*, Queensland; B, *Protopterus annectens*, Gambia; C, *Lepidosiren paradoxa*, Paraguay. The lozenge-shaped markings on the surface of B do not represent scales, but areas of the skin outlined by pigment cells. In a fresh specimen the scales are completely invisible, as in C. (A, from Gunther; B and C, from Lankester.)

which, as Darwin says, "coat the rocks all over the world in infinite numbers." The Dipnoans, or Lungfishes (having lungs as well as gills, such as the *Ceratodus* and *Lepidosiren*), which are represented by several living species in Australia and South Africa, are the remains of a tribe found in whole shoals in the Carboniferous, Triassic, and Jurassic rocks, but not, so far as I know, in any of the intervening rocks. The living *Ceratodus* (Fig. 23) was only discovered in 1870, and was regarded as a marvel of "persistence." On a pinch, as when his native streams dry up, this curious fellow can get along all right without water, breathing air by his lungs like a land animal. If in the meantime he was off on a trip to the moon, he must have "persisted" a few million years without either.

But his cousin, the *Polypterus* of the Upper Nile, has a still more amazing record, for he has actually skipped all the formations from the Devonian down to the modern; while the Limuloids, or sea scorpions, have jumped from the Carboniferous down.

The Mollusks and Brachiopods would afford us examples too numerous to mention. How is it possible that these numerous families disappear suddenly and completely with the Mesozoic or even the "early" Palæozoic, and are not found in any "later" deposits, though alive now in our modern world? Parts of Europe and America have, we are told, been down under the sea and up again a dozen times since then; why then should we not expect to find abundant remains of these "persistent" types in the

Mesozoic and Tertiaries? Surely these feats of time-acrobatics show the folly of arranging *contemporaneous, taxonomic groups* in single file and giving to each a time value.

The Chalk points a similar lesson. It was not till the time of the "Challenger" Expedition that the modern deposits of Globigerina ooze (Fig. 25), made

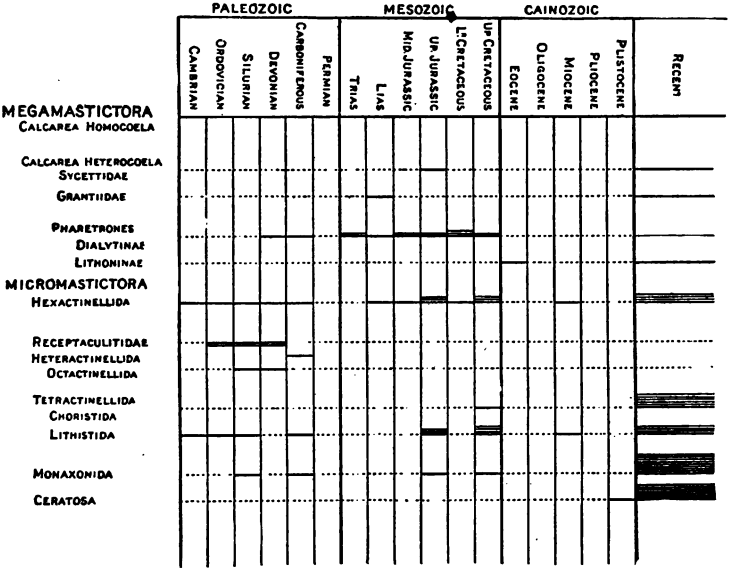



FIG. 24 — Table to indicate distribution of Sponges in time. (After I. B. J. Sollas.) This is a photographic reproduction of the diagram given by this author in "The Cambridge Natural History." Unlike most diagrams of this kind, this sketch honestly shows in just what formations Sponges are found, as well as those that they skip. Comment is unnecessary.

up of hundreds of species identical with those of the Chalk, were known to be now forming over vast areas of the ocean floor. In the words of Huxley, these modern species "bridge over the interval be-

tween the present and the Mesozoic periods." ("Discourses Biological and Geological," p. 347.)

As for the silicious Sponges found in the Chalk (see Fig. 24), which were such puzzles for the scientists during the first half of the nineteenth century, because their living forms were unknown, the deep sea investigations have solved the problem, for in 1877 Sollas demonstrated "the identity of their structure with that of living Hexactinellids, Lithistids, and Monactinellids." (Zittel, "History of Geology," p. 388.)

And yet with all the vicissitudes of the continents during the "millions of years" since the Cretaceous age, there is so far as I am aware not a trace of either the Chalk or the Sponges in any of the "subsequent" rocks. Pieces of Cretaceous rock are of course found thus sporadically as boulders, but there is no natural deposit of this kind. But in the light of these modern discoveries, why is not the Chalk of "the white dear cliffs of Dover," full of modern living species as we now know it to be, just as "recent" a deposit as the "late" Tertiaries or the Pleistocene?

Here is a curious list of instances of skipping as given by Dana:

A few land Snails are found in the Carboniferous, but no land Snails have been recognized from the Permian, Triassic, or Jurassic formations. In the Cretaceous they reappear, and from that time the series is substantially continuous. A few Scorpions are found in the Upper Silurian; none have been recognized from the Devonian; but in the Carboniferous both Scorpions and Spiders occur. Both these

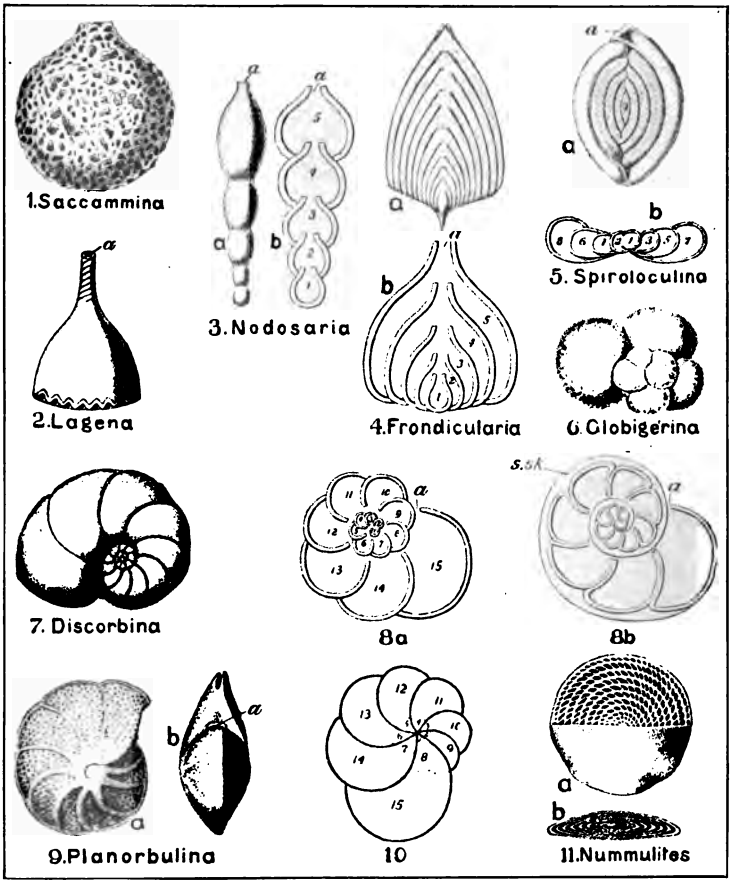



FIG. 25 — Shells of *Foraminifera*. In 3, 4, and 5, *a* shows the surface view, and *b* a section. 8*a* is a diagram of a coiled cell without supplemental skeleton; 8*b* of a similar form with supplemental skeleton (*s. sk*); and 10 of a form with overlapping whorls. In 11*a* half the shell is shown in horizontal section; *b* is a vertical section; *a*, aperture of the shell; 1-15, successive chambers, 1 being always the oldest or initial chamber. (From Parker and Haswell, after other authors.)

"There is nothing more wonderful in nature than the building up of these elaborate and symmetrical structures by mere jelly-specks, presenting no traces whatever of that definite organization which we are accustomed to regard as necessary to the manifestations of conscious life. . . . The tests (shells) they construct, when highly magnified, bear comparison with the most skilful masonry of man." (Carpenter.)

groups appear to be missing from the Permian and from the whole series of Mesozoic strata. They reappear in the Tertiary. Amphibians of the order Labyrinthodonts appear in the Subcarboniferous (or, probably, in the Devonian), and continue through the Triassic, possibly into the beginning of the Jurassic. The class of Amphibians then remains unrepresented until a Salamander appears in the Lower Cretaceous. —*"Revised Text-Book," p. 459.*

Any comment on this would be quite superfluous.

Another good illustration of the absurdity of the usual arrangement of the rocks is found in the Echinoderms — Crinoids, Starfishes, Sea-urchins, etc. Of the latter, Prof. A. Agassiz found in the deep waters of the West Indies four genera of Echinids or Sea-urchins of the "later Tertiary," but twenty-four genera of the "early Tertiary," ten of the Cretaceous, and five of the Jurassic. (Dana, "Manual," p. 59.)

But far from being uncommon, we know that similar discoveries have been in almost constant progress during the last half-century. And were it not that "zoological students are," as Zittel says, "too actively engaged and keenly interested in building up new observations to attempt to spell through the arbitrary palæontological conclusions" found in the "dead weight of stratigraphical-palæontological literature," there is no telling what hosts of similar facts might be pointed to regarding the forms found in all the "older" rocks.

Of the Starfishes and Serpent-stars (*Asteridea* and *Ophiuridea*), Zittel says: "It would seem that the Palæozoic 'sea-stars' differed very little from

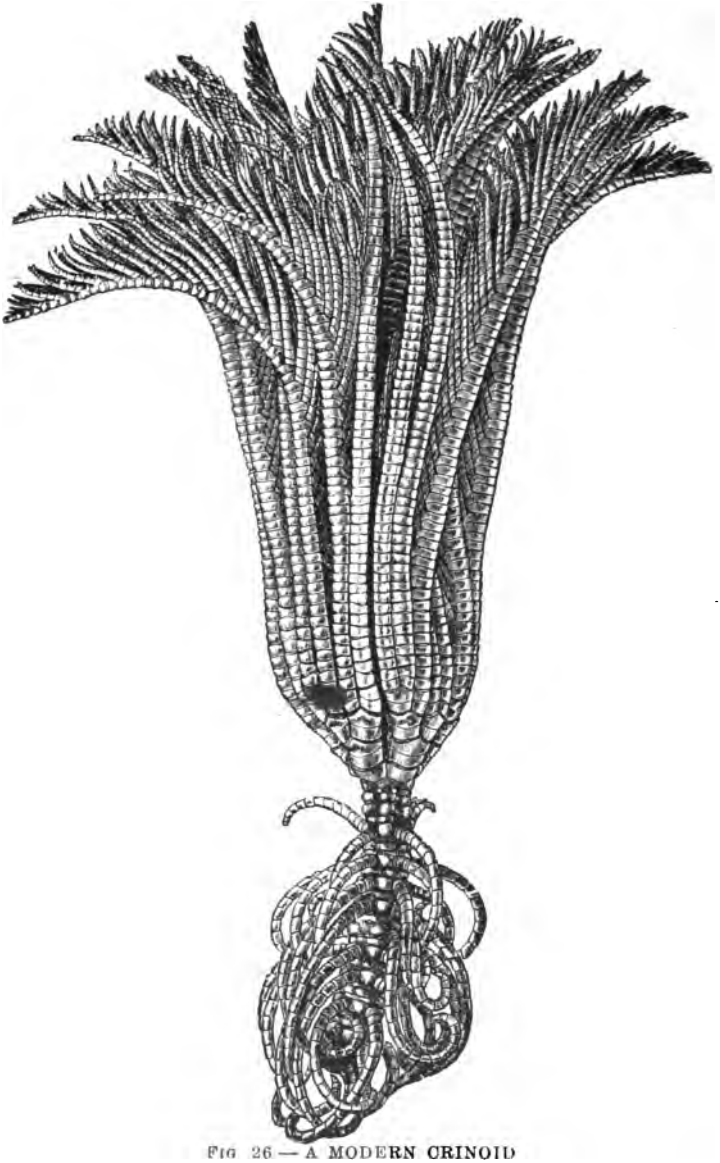


FIG 26 — A MODERN CRINOID

Arms and portion of stem of *Pentacrinus maclearanus*, slightly enlarged. (From Wyville Thomson.)

those in the seas of the present age." (P. 395.) The Crinoids (see Fig. 26), we are told, "are among the earliest in geological history," making up vast limestones of the Palæozoic rocks; and forms scarcely separable from the modern are found in the Jurassic, but so far as the text-books tell us, are *absolutely unknown in any later deposits.* But there are several modern genera, such as Pentacrinus, Rhizocrinus, Bathycrinus, etc., found in the deep waters of nearly all the oceans. The genus Rhizocrinus was discovered off the coast of Norway about the sixties of the last century. But what were these creatures doing since "Jurassic times," while the "pulsating crust" was putting parts of the continents under the sea for ages at a stretch? Why did they form no deposits during the Cretaceous, Eocene, Miocene, or Pliocene ages? Surely the absurdity of the present arrangement is evident to a child. During all these intervening ages the climate of the globe continued of the same remarkable mildness, fossils of all these formations being found about as far north as explorers have ever gone. Why did the Crinoids and Corals suspend business from "Jurassic times" to the "recent," merely to accommodate a modern theory? Dana says that "the coral reefs of the Oolite in England consist of Corals of the same group with the reef-making species of the existing tropics" ("Manual," p. 793), and he argues from this fact that the mean temperature of the waters must have been about 69° F. But a luxuriant vegetation still continued in the Arctic regions during the

Cretaceous and the Tertiaries. How absurd to say that these Corals built no reefs about the European coasts during all these ages! Or, to put the matter in another way, considering how many of their characteristic types are alive in our modern seas, why should we say that the crinoidal or coral limestones of the Mesozoic or Palæozoic rocks are not as recent as the nummulitic limestones of the Eocene or any late Tertiary deposits?

FIG. 27 — *Pleurotomaria adansoniana* Cr. and F., Tobago. x 1-3. This genus of Mollusks seems to have skipped from the Jurassic down. It was long supposed to be extinct. More than 1,100 fossil species have been described; but within the last generation some twenty specimens, belonging to five species, have been discovered at great depths off Japan and the West Indies.

But let us try the Tree-ferns and Cycads of the coal-beds of the "older" rocks. In northern regions they are not found "later" than the Triassic and Jurassic; and doubtless the same holds good of the rocks in the tropics, where the modern species now live in fair abundance. But how did they come to shift to the tropics so many millions of years before the Palms, etc., of the Tertiaries thought it time to do the same? The climate had not changed a bit; how did they come to scent the coming "Glacial age" so much earlier than their more highly organized fellows?

The "Challenger" expedition found some Cyathophylloid Corals now building reefs at the bottom of our modern ocean. The geologists had already assigned *the last* of them to the Carboniferous and Permian rocks, with the idea that they were extinct. But where have these fellows kept themselves during all the intervening ages while the continents were deep under the ocean time and time again? or why are not the rocks containing their fossils as "recent" as any deposits on the globe?

And so I might go on. There is hardly a tribe found in the "older" rocks which does not have its living representatives of to-day, and with, I believe, a fair proportion of the species identical; though in hundreds, perhaps thousands of cases these species, genera, or even whole tribes, have somehow skipped all the intervening formations.

These things help to show that the geological classifications do not really represent successive ages, but are merely taxonomic classifications. These absurdities about skipping have come about because the whole fossiliferous series was all laid off from the bottom to the top many years before it was acknowledged that any really "modern" forms are to be found in the rocks. But such absurdities can only increase with further discoveries, and will only cease when we discard all time values as attaching to particular types of life, and, beginning with the present, work back into the past to find where and how the fossils of all our modern species occur. In this way only can the science be reformed and the present absurdities eliminated.

But let us drop this method of studying our subject, and look at it from a slightly different point of view.

Thus Dana says that "the absence of Lamellibranchs in the Middle Cambrian, although present in both Lower and Upper, means *the absence of fossils from the rocks, not of species from the faunas.*" ("Manual," p. 488.)

He puts this in italics, as I have done; for it is certainly a reasonable idea, and as A. R. Wallace says, "No one *now* doubts that where any type appears in two remote periods it must have been in existence during the whole intervening period, although we may have no record of it." ("Distribution of Life," p. 33.) But what would be the result if we should extend this idea to its logical conclusion? It seems to be an effort to avoid one of the absurdities of the onion-coat theory, without, however, discarding that theory altogether.

In speaking of some Corals and Crinoids of the Devonian which "were absent" from some of the divisions of this formation because the conditions of the seas about New York "were unfavorable," Dana says that "they were back when the seas were again of sufficient purity." ("Manual," p. 611.)

In his review of these formations he enlarges on this subject:

> At the close of the early Devonian the evidences of clear seas — the Corals and Crinoids, with most of the attendant life — disappear, migrating no one knows whither. . . . With the variations in the fineness, or other characteristics of the beds, as H. S. Williams has illustrated, the species vary.

. . . THE FAUNAS OF EACH STRATUM ARE NOT STRICTLY FAUNAS OF EPOCHS OR PERIODS OF TIME, BUT LOCAL TOPOGRAPHICAL FAUNAS. After the Corniferous period, Corals, Crinoids, and Trilobites still flourished somewhere, as before, but they are absent from the Central Interior until the Carboniferous age opens.—*"Manual," pp. 628, 629.*

Here we are certainly getting a refreshing breath of common-sense geology; but what would become of current theories if we should enlarge on this idea?

What if the gigantic Dinosaurs of the Cretaceous or the equally marvelous Mammals of the "early" Tertiaries of the Western States, described by Marsh and Cope, and the Pleistocene Mammals of other parts of America and of Europe and Northern Siberia, "are not strictly faunas of epochs or periods of time, but local topographical faunas"? What if the world-wide limestones of the Cambrian and Silurian, and the no less enormous or wide-spread nummulitic limestones of the Eocene, extending from the Alps to Eastern Asia, and constituting mountains ten, fifteen, or twenty thousand feet high — what if these are possibly *contemporaneous with one another?* Supposing the Coal-measures of Nova Scotia and Pennsylvania, and the Cretaceous and Tertiary lignites of Vancouver Island, Alberta, and the Western States, are not strictly floras of epochs or periods of time, but local topographical floras, and contemporary with each other?[6]

[6] This is only carrying the argument a little further than Huxley does when he says that "a Devonian fauna and flora in the British Islands may have been contemporaneous with Silurian life in North America, and with a Carboniferous fauna and flora in Africa. Geographical provinces and zones may have been as distinctly marked in the Palæozoic epoch as at present." ("Discourses," p. 286.)

In short, what possible means have we of proving of any two distinct life assemblages that they could not have coexisted on the earth in separated localities? Every candid man capable of appreciating scientific evidence must acknowledge that there is no such proof.

From all this it must be evident that the fossil world is a unit; that the different kinds of life do not and can not mean successive ages, but that they are simply contemporary plants and animals all existing together in an older state of the world as we know it. The time and manner of the burial of these life forms is a subject for further study, and will be considered in subsequent chapters.

Let us sum up the net results of our studies. Rocks are called Devonian, Triassic, Eocene, or whatever, because of the fossils they happen to contain. When a new group of strata is found, its position in the series is determined by comparing its fossils with those of the formations already established, no matter what its stratigraphical relationship may be to the rocks above it or below. Hence these geological distinctions or classifications are purely artificial or conventional in character, and merely represent old taxonomic relationships, nothing more. In the face of the history of the idea, and of the purely haphazard way in which the various life groups are now found to occur, as well as of the artificial and conventional way in which the members of these formations have been pieced together from scattered localities, all claim about the results of these labors

really representing a natural time value appears so nonconsequential and fallacious to the student of other branches of science that it must soon make geology a laughing-stock, unless we speedily discard these traditional time values, and reconstruct our fundamental theories on a sure inductive basis in accordance with the sum total of modern discoveries. The recognized classifications will remain, though stripped of their time values; and our science, instead of being deduced from postulated past conditions regarding an imaginary beginning of things, will content itself with starting with the present and the sum total of modern ascertained facts, and in their light reconstructing whatever is possible of past conditions by sound inductive methods.

By these methods of strict inductive science we shall not be able to avoid the conclusion that our world has witnessed an awful aqueous catastrophe, and that back of this lies a direct and real Creation as the only possible origin of things. In short, a strictly inductive and mature study of the facts of geology as known to modern science confirms in a very marvelous way the literal interpretation of the first chapters of Genesis, which a pseudo-criticism and the infant lispings of science supposed they had consigned to the realm of fable and myth.

# PART TWO

## ADDITIONAL FACTS FOR THE BASIS OF A TRUE INDUCTION

# CHAPTER IX

## Graveyards

"THE crust of our globe," writes a distinguished scientist, "is a great cemetery, where the rocks are tombstones on which the buried dead have written their own epitaphs." The reading of these epitaphs is the business of geology; and too often, as we shall see, the record is that of a violent and sudden death.

With the doctrine of uniformity as a theoretical proposition, I shall have little to say. At best it is a pure assumption that the present quiet and regular action of the elements has always prevailed in the past, or that this supposition is sufficient to explain the facts of the rocks. In its more extreme form it becomes an iron dogma, which shuts out all evidence not agreeable to its teachings. But in its essential nature, whether in its least or its most extreme form, it is not approaching the subject from the right standpoint. It is not following the method of scientific research, but the method of lazy, scholastic guesswork.

It seeks to show how the past geological changes *may* have occurred; it never attempts to prove how they *must* have occurred. And I may say in passing, that it is largely for the purpose of avoiding the cumulative character of the evidence gathered from

every stone-quarry and from every section of strata in every corner of the globe, that the uniformitarians have wished to have these burials take place on the instalment plan; for otherwise the violent and catastrophic character of the events recorded in the rocks would become too plainly manifest. But, begging the reader's pardon for repeating here an illustration already used in a previous chapter, if a coroner, called upon to hold an inquest, were to content himself, after the manner of Lyell and Hutton, with glittering generalities about how people are all the time dying of old age, fever, or other causes, coupled with assurances of the quiet, regular habits and good reputation of all his fellow citizens, I do not think that he would be praised for his adherence to inductive methods if we could get at clear and decisive evidence that the poor fellow under examination had been shot. Just so with common-sense methods in geology. *A true induction is capable of finding out for certain* whether or not the present quiet, regular action of the elements has always prevailed in the past; and it is most unscientific to assume, as the followers of Hutton and Lyell have done, that the comparatively insignificant changes within historic time have always prevailed in the past, when there is plenty of clear and decisive evidence to the contrary.

Prof. Alleyne Nicholson, it is true, thinks that the geological phenomena are only "a question of energy *versus* time." "We may," he says, "on the one hand suppose them to be the result of some very

powerful cause, acting through a short period of time. Or we may suppose them to be caused by a much weaker force acting through a proportionately prolonged period."

This might be so if we had only to consider *mere quantity* of deposition or erosion. But when we consider the quality or kind of work the case is very different. A Hercules by ages of toil might pile up stone and brick to the region of the clouds; but no mere quantity of his clumsy work could create the Pyramid of Cheops or the Hall of Karnak. An eternity of hacking at stone with a hammer might be supposed capable of leveling the Alps or the Himalayas; but it could never produce a Venus de Milo or a Parthenon. And it seems to me that we must shut our eyes to all the evidence if we are still to maintain that untold ages of quiet deposition like that within our historic experience would ever produce the quality of work which is opened up to our wondering eyes in almost every quarter of the globe.

The general fact which I wish to develop in this chapter may be stated as follows:

*Rocks belonging to all the various systems or formations give us fossils in such a state of preservation, and heaped together in such astonishing numbers, that we can not resist the conviction that the majority of these deposits were formed in some sudden and not modern manner, catastrophic in nature.*

But before giving any examples of these abnormal deposits, we must first study the modern normal

deposits; before we can rightly understand the sharp contrast between the ancient and the modern action of the elements, we must become familiar with the way in which fossils are now being buried by our rivers and oceans.

One of the many geological myths dissipated by the work of the "Challenger" expedition, which, as Zittel says, "marks the grandest scientific event of the nineteenth century," is that about the ocean bottom and the work now being carried on there. The older text-books taught that not only was the bottom of the ocean thickly strewn with the remains of the animals which died there and in the waters above, but also that the oceanic currents were constantly wearing away in some places and building up in others over all the ocean floor, and hence producing true stratified deposits. Accordingly it was said that it was only necessary for these beds to be lifted above the surface to produce the ordinary rocks that we find everywhere about us. But we now know that the ocean currents have, as Dana says, "*no sensible, mechanical effects, either in the way of transportation or abrasion.*" ("Manual," p. 229.) We know also that all kinds of sediment drop so much quicker in salt water than in fresh, that none of it gets beyond the narrow "continental shelf" and the classic 100 fathom line, which in most cases is not very far from shore. In the north Atlantic there are sediments found in deeper water produced by ice-floes or icebergs dropping their loads there; but we can not suppose such work to have gone on

when the Arctic regions were clothed with a temperate-climate vegetation, much less that such things occurred over all the earth. On the floor of the open ocean, and away from the tracks of our modern icebergs, we have four or five kinds of mud or ooze formed from minute particles of organic matter; but besides these, absolutely nothing save a possible sprinkling of volcanic products, which of course are limited in their distribution. Where then can we find a stratified or bedded structure now being formed over the ocean bottom? Sir John Murray, in his "Report on Deep Sea Deposits," has shown in "a most thorough and convincing manner," to quote the strong words of Professor Suess, that there is nothing of the kind now being produced there. There is *no gravel, no sand, no ordinary clay;* but whatever variation we may imagine to take place in the organic deposits could never produce a real stratified or bedded structure.

The so-called Red Clay deposits of the deep ocean cover about 36 per cent of the oceanic area, or about 50,000,000 square miles, the Globigerina ooze making up over 29 per cent, or 40,000,000 square miles. Both of these deposits, covering as they do the greater part of the whole ocean bottom, are so entirely different from anything found in the fossiliferous rocks that most geologists admit the total dissimilarity. Of course the species of the Globigerina and other oozes are like those found fossil in the Cretaceous rocks, but the mechanical structure of the two is entirely different; while in the case

of the Red Clay, which can hardly be said to contain animal remains, it is admitted that there is nothing like it through the whole range of the fossiliferous rocks from the Cambrian to the Pleistocene.

Thus to explain practically all the deposits found in the rocks, we are absolutely limited to the shore deposits and the mouths of large rivers. Here we certainly have alternations of sand, clay, and gravel, producing a true bedded structure. But I ask, What kind of organic remains will we get from these modern deposits? Certainly nothing like the crowded graveyards which we find everywhere in the ancient ones.

Darwin, in his famous chapter on "The Imperfection of the Geological Record," has well shown how scanty and imperfect are the modern fossiliferous deposits. The progress of research has only confirmed and accentuated the argument there presented on this point. Thus Nordenskiöld, the veteran Arctic explorer, remarks with amazement on the scarcity of recent organic remains in the Arctic regions, where such a profusion of animal life exists; while in spite of the great numbers of Cats, Dogs, and other domestic animals which are constantly being thrown into rivers like the Hudson or the Thames, dredgings about the mouths of these streams have revealed the surprising fact that scarcely a trace of any such animals is there to be found. (*Popular Science Monthly,* Vol. 21, pp. 143, 693.)

Even the Fishes themselves stand a very poor chance of being buried intact. As Dana puts it:

Vertebrate animals, as Fishes, Reptiles, etc., which fall to pieces when the animal portion is removed, *require speedy burial after death,* to escape destruction from this source [decomposition and chemical solution from air, rain-water, etc.], as well as from animals that would prey upon them.—*"Manual," p. 141.*

If a vertebrate Fish should die a natural death, which of itself must be a rare occurrence, the carcass would soon be devoured whole or bit by bit by other creatures near. Possibly the lower jaw, or the teeth, spines, etc., in the case of Sharks, or a bone or two of the skeleton, might be buried unbroken, but a whole vertebrate Fish entombed in a modern deposit is surely a unique occurrence.

But every geologist knows that the remains of Fishes are, in countless millions of cases, found in a marvelous state of preservation. They have been *entombed in whole shoals,* with the beds containing them miles in extent, and scattered over all the globe. Indeed, so accustomed have we grown to this state of affairs in the rocks we hammer up, that if we fail to find such well-preserved remains of vertebrate Fishes, land animals, or plants, we feel disappointed, almost hurt; we think that nature has somehow slighted this particular set of beds. But where in our modern quiet earth will we go to find deposits now forming like the copper slate of the Mansfield district, the Jurassic shales of Solenhofen, the calcareous marls of Œningen on Lake Constance, the black slates of Glarus, or the shales of Monte Bolca? —to mention some cases from the continent of Europe more than usually famous in the literature

for exquisitely preserved vertebrate Fishes, to say nothing of other fossils. According to Dana, all these must have met with a "speedy burial after death" — perhaps before; who knows?

Buckland, in speaking of the fossil Fish of Monte Bolca, which may be taken as typical of all the others, is quite positive that these Fish must have "perished suddenly," by some tremendous catastrophe.

"The skeletons of these Fish," he says, "lie parallel to the laminæ of the strata of the calcareous slate; they are always entire, and so closely packed on one another that many individuals are often contained in a single block. . . . *All these Fish must have died suddenly* on this fatal spot, and have been speedily buried in the calcareous sediment then in course of deposition. From the fact that certain individuals have even preserved traces of color upon their skin, we are certain that they were entombed before decomposition of their soft parts had taken place." ("Geol. and Min.," Vol. 1, pp. 124, 125, ed. 1858.)

In many places in America as well as Europe, where these remains of Fish are found, the shaley rock is so full of fish-oil that it will burn almost like coal, while some have even thought that the peculiar deposits like Albertite "coal" and some cannel-coals were formed from the distillation of the fish-oil from the supersaturated rocks.

De la Beche was also of the opinion that most of the fossils were buried suddenly and in an abnormal manner. "A very large proportion of them," he

says, "must have been *entombed uninjured, and many alive,* or, if not alive, at least before decomposition ensued." ("Theoretical Geology," p. 265, London, 1834.) In this he is speaking not of the Fishes alone but of the fossiliferous deposits in general.

There is a series of strata found in all parts of the world which used to be called the "Old Red Sandstone," now known as the Devonian. In this, almost wherever we find it, the remains of whole shoals of Fishes occur in such profusion and preservation that the "period" is often known as the "Age of Fishes." Dr. David Page, after enumerating nearly a dozen genera, says:

> These Fishes seem to have thronged the waters of the period, and their remains are often found in masses, as if they had been suddenly entombed in living shoals by the sediment which now contains them.

I beg leave to quote somewhat at length the picturesque language of Hugh Miller regarding these rocks as found in Scotland:

> The river Bullhead, when attacked by an enemy, or immediately as it feels the hook in its jaws, erects its two spines at nearly right angles with the plates of the head, as if to render itself as difficult of being swallowed as possible. The attitude is one of danger and alarm; and it is a curious fact, to which I shall afterward have occasion to advert, that *in this attitude nine tenths of the Pterichthes of the Lower Old Red Sandstone are to be found.* . . . It presents us, too, with a wonderful record of violent death falling at once, not on a few individuals, but on whole tribes. . . .
>
> At this period of our history, some terrible catastrophe involved in sudden destruction the Fish of an area at least a hundred miles from boundary to boundary, perhaps much more. The same platform in Orkney as at Cromarty is

strewed thick with remains, which exhibit unequivocally the marks of violent death. The figures are contorted, contracted, curved, the tail in many instances is bent round to the head; the spines stick out; the fins are spread to the full, as in Fish that die in convulsions. . . . The record is one of destruction at once widely spread and total, so far as it extended. . . . By what quiet but potent agency of destruction were the innumerable existences of *an area perhaps ten thousand square miles in extent annihilated at once,* and yet the medium in which they had lived left undisturbed in its operations?

Conjecture lacks footing in grappling with the enigma, and expatiates in uncertainty over all the known phenomena of death.—*"Old Red Sandstone," pp. 48, 221, 222.*

I will not taunt the uniformitarians by asking them to direct us to some modern analogies. But I would have the reader remember that these Devonian and other rocks are world-wide in extent.

Surely Howorth is talking good science when he says that his masters Sedgwick and Murchison taught him "that no plainer witness is to be found of any physical fact than that Nature has at times worked with enormous energy and rapidity," and "that the rocky strata teem with evidence of violent and sudden dislocations on a great scale."

I have spoken only of the class Fishes. But what other class of the animal kingdom will not point us a similar lesson? The Reptiles and Amphibians, to say nothing of the larger Mammals, are also found in countless myriads, packed together as if in natural graveyards. Everybody knows of the enormous numbers and splendid preservation of the great Reptiles of the Western and Southern States, untombed by Leidy, Cope, and Marsh. One patch

of Cretaceous strata in England, the Wealden, has afforded over thirty different species of Dinosaurs, Crocodiles, and Plesiosaurs. Mr. Charles H. Sternberg, one of Zittel's assistants, recently reported great quantities of Amphibians from the Permian of Texas. They are of all sizes, some Frogs being six feet long, others ten. Besides these he found "three bone-beds full" of minute forms an inch or less in length. Of the small ones, which I judge must represent whole millions of young ones suddenly entombed, he says:

> I got over twenty perfect skulls, many with vertebræ attached, and thousands of small bones from all parts of the skeleton. In one case, a complete skull, one fourth of an inch in length, had connected with it nearly the entire vertebral column, with ribs in position, coiled upon itself, bedded with many bones of other species in a red silicious matrix. So perfectly were they weathered out that they lay in bas-relief as white and perfect as if they had died a month ago; a single row of teeth, like the points of cambric needles, occupied both sets of jaws.—*"Popular Science News," May, 1902, pp. 106, 107.*

How many more such cases there may have been in these "three bone-beds full" of similar remains, it would be interesting to know. But though somewhat aside from the present subject, I can not refrain, in passing, from referring to the wonderful preservation of these remains. It is preposterous to say that these bones have lain thus exposed to the weather for the length of time postulated by the popular theory. There is not a particle of scientific evidence to prove that they are not just as recent as any specimen from the Tertiaries or the

Pleistocene. Buffon and Cuvier proved the Mammals to be of "recent" age, because they occurred in the superficial deposits. They never heard of the Triassic, Jurassic, and Cretaceous of Colorado and Wyoming, nor these Permian beds of Texas. Think of this frog's teeth "like the points of cambric needles," and he and his fellow as "perfect as if they had died a month ago." Of one of the big six-foot specimens this author says, "Its head was so beautifully preserved, and cleaned under long erosion, *it was difficult to believe it was not a recent specimen;*" while of the little six-inch fellow referred to above he says, "The bones of the skull are perfectly preserved, quite smooth, and show the sutures distinctly; there is no distortion; some red matrix attached below seems absolutely necessary to convince the mind that it is not *a thing of yesterday.*" James Geikie mentions the case of the Elgin sandstones "formerly classed as 'Old Red,'" but which are now called Triassic, "from the fact that they have yielded reptilian remains of a higher grade than one would expect to meet with in Old Red Sandstone." ("Historical Geology," p. 53.) Since these strata slide up and down so easily, we have here far more urgent scientific reasons for calling these Amphibian remains of Texas among the most "recent" geological deposits on the globe.

But I must return to my subject. The Invertebrates are also eloquent to the fact of abnormal conditions having prevailed when their remains were entombed. We could go through the whole list, but

it is the same old story of abnormal deposits, essentially different from anything that is being made to-day.

Where, for instance, in the modern seas, will we find Corals now being intercalated between beds of clays or sands over vast areas, as we find them in the Lias and Oolite of England and elsewhere? Corals require a definite depth of water, neither too deep nor too shallow, but it must be clear and pure; and nothing but some awful catastrophe could place a bed of Coral remains a few feet or a few inches in thickness over the vast areas where we find them. Crinoids require the same clear, pure water, but much deeper, some of the modern kinds living over a mile down, where there is no sand, no clay, absolutely nothing to disturb the eternal calm. But every student of the science knows that the Subcarboniferous limestone of both Europe and America (called mountain limestone in England), so noted for its Crinoids and its Corals, is constantly found intercalated between shale or sandstone, or between the coal-beds themselves, as at Springfield, Illinois, or in the Lower Coal-measures of Westmoreland County, Pennsylvania. There are of course, here and there, great masses of these rocks which represent an original formation by growth *in situ;* but no sane man can say this for these great sheets perhaps only a few inches in thickness, for in many cases they show a stratified or bedded structure just as much as a sandstone or a shale. In some tables given by Dana on pages 651, 652, of his "Manual," compiled

from four different localities, I count no less than twenty-three beds of limestone thus intercalated between coal-beds, though we are not told how many of them contain Corals or Crinoids. Such details are generally omitted as of little consequence.

Next, let us try the Lamellibranchs, such as the Clam, Oyster, and other true bivalves. These creatures have an arrangement in the hinge region by which the valves of the shell tend to open, but during life are held together by the adductor muscles. When dead, however, these muscles relax and decay, and then the valves spread open. Forms which burrow deeply, as *Solen, Lutraria, Mya,* etc., often gape widely, and even if they died a natural death in their holes, some mud must inevitably wash into their burrows, filling their empty shells. But many kinds of bivalves do not thus burrow in the ground; and when the fossils of such kinds are found in quantity with the valves applied and often hollow, as is so frequently the case in many of the "older" rocks, I can not see how we are to understand any ordinary conditions of deposit. And yet we are gravely assured by a high authority, that "a sudden burial is not necessary to entombment in this condition."

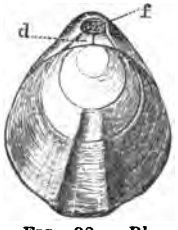



FIG. 28 — *Rhynchonella Bouëti.* (Cornbrash.) *d,* Deltidium; *f,* foramen.

Or let us take the Brachiopods. These have a bivalve shell, the parts of which, however, are not pulled apart after death, and only need to open a little way even in life to admit the sea water which

brings them their food. Yet, though the valves do not gape after death, there is when dead and empty a hole at the hinge or beak (see Figs. 28, 29), which would readily admit mud if such were present in the water, or if the shells after death were subject to the ordinary movements of tide, wave, and current. Yet Dawson says of the Brachiopods *Spirifer* and *Athyris:*

> I may mention here that in all the Carboniferous limestones of Nova Scotia the shells of this family are usually found with the valves closed and the interior often hollow.—*"Acadian Geology," p. 260.*


FIG. 29 — *Terebratula sella.* (Lower Greensand.) *d*, Deltidium; *f*, foramen.

Of course he tries to explain how this state of things might occur "in deep and clear water"—for some of the modern species are found in the clear depths 18,000 feet down — and he thinks that their entombment in this condition "does not prove that the death of the animals was sudden." This was written in the old days when people knew nothing of conditions on the ocean bottom. But we now know that there is no means of producing a stratified formation in this "deep and clear water," and hence that some revolution of nature is implied by the conditions in which we find them.

Some people seem to have converted David Hume's famous sentence into a scientific formula, thus: "Anything contrary to uniformity is impos-

sible; hence no amount of evidence can prove anything contrary to uniformity."

For the trouble in this case is that not only do such conditions prevail "in all the Carboniferous limestones of Nova Scotia," which must be several thousands of square miles in extent, but in the Devonian shales and Silurian limestones throughout North America at least — doubtless over the rest of the world — the Brachiopods are found in this same telltale condition, and it would establish a very dangerous precedent to admit abnormal conditions in even a single case.

I have only touched upon the voluminous evidence that might be adduced in the case of the lower forms of life. Had I the space, I might show how the marvelously preserved plants of the coal-beds tell the same story. But we must pass on to consider the remains of the larger land animals. I have already given a quotation from Dana about the Mammoth and Rhinoceros in Northern Siberia, where he says that their encasing in ice and the perfect preservation of their flesh "shows that the cold finally became suddenly extreme, as of a single winter's night, and knew no relenting afterward." Not very many serious attempts have been made to account for this remarkable state of things, which is a protest against uniformity that can be appreciated by a child, and I never heard of any theory which attempted to account for the facts without some kind of awful catastrophe.

Many, however, seem to have little idea of the

extent of these remains in the Arctic regions. They are not all thus perfectly preserved, for thousands of skeletons are found in localities where the ground partially thaws out in the short summer, and here of course the skin and tissues could not remain intact. Remains of these beasts occur in only a little less abundance over all Western Europe, and the Mammoth also in North America, well preserved specimens having been obtained from the Klondike region of Alaska; and there is nothing to forbid the idea that many if not most of these latter specimens were also at one time enshrined as "mummies" in the ice and frozen soil which has since thawed out over the more temperate regions. But we must confine ourselves to the remains in Siberia. Flower and Lydekker tell us that since the tenth century at least, these remains have been quarried for the sake of the ivory tusks, and a regular trade in this fossil ivory, in a state fit for commercial purposes, has been carried on "both eastward to China, and westward to Europe," and that "fossil ivory has its price current as well as wheat."

They are found at all suitable places along the whole line of the shore between the mouth of the Obi and Bering Straits, and the further north the more numerous do they become, the islands of New Siberia being now one of the favorite collecting localities. The soil of Bear Island and of Liachoff Islands is said to consist only of sand and ice with such quantities of Mammoth bones as almost to compose its chief substance. The remains are not only found around the mouths of the great rivers, as would be the case if the carcasses had been washed down from more southern localities in the interior of the continent, but are imbedded in the

frozen soil in such circumstances as to indicate that the animals had lived not far from the localities in which they are now found, and they are exposed either by the melting of the ice in unusually warm summers, or by the washing away of the sea cliffs or river banks by storms or floods. In this way the bodies of more or less nearly perfect animals, even standing in the erect position, with the soft parts and hairy covering entire, have been brought to light.—"*Mammals,*" *p. 430.*

But these remains of the Mammoth, though the best known, are not the only ones attesting extraordinary conditions, though of course in warmer latitudes we do not find perfect "mummies" with the hide and flesh preserved untainted. Let us go to a warmer climate, to Sicily, and read a description of the remains of the Hippopotamus found there. I quote from Sir Joseph Prestwich:

The chief localities, which center on the hills around Palermo, arrest attention from the extraordinary quantity of bones of Hippopotami (in complete hecatombs) which have there been found. Twenty tons of these bones were shipped from around the one cave of San Ciro, near Palermo, within the first six months of exploiting them, and they were so fresh that they were sent to Marseilles to furnish animal charcoal for use in the sugar factories. How could this bone breccia have been accumulated? . . . The only suggestion that has been made is that the bones are those of successive generations of Hippopotami which went there to die. But this is not the habit of the animal, and besides, the bones are those of animals *of all ages down to the fœtus*, nor do they show traces of weathering or exposure. . . .

My supposition is, therefore, that when the island was submerged, the animals in the plain of Palermo naturally retreated, as the waters advanced, deeper into the amphitheater of hills until they found themselves embayed, as in a seine, with promontories running out to sea on either side and a mural precipice in front. As the area became more

and more circumscribed the animals must have thronged together in vast multitudes, crushing into the more accessible caves, and swarming over the ground at their entrance, until overtaken by the waters and destroyed.—*"On Certain Phenomena," etc., pp. 50-52.*

Our author then adds this summary of his argument:

The extremely fresh condition of the bones, proved by the retention of so large a proportion of animal matter, and the fact that animals of all ages were involved in the catastrophe, shows that the event was geologically, comparatively recent, as other facts show it to have been sudden.

That it must have been a good deal more "sudden" than even this author will admit, is evident from the nature of the Hippopotamus. I never thought that it was particularly afraid of the water, or likely to be drowned by any such moderate catastrophe as Prestwich invokes in this very singular volume. The reader must, however, note that this affair, like the entombment of the Mammoth, certainly took place since Man was upon the globe, even according to the uniformitarians. Would it not be economy of energy to correlate the two? But if Man dates from "Miocene times," as some contend, he must have witnessed half a dozen awful affairs like these, according to the common view, for there is scarcely a country on the globe that has not been under the ocean since then.

Let us proceed.

But whither shall we turn to avoid finding similar phenomena? The vast deposits of Mammals in the Rocky Mountains may occur to the reader. As Dana

says, they "have been found to be literally Tertiary burial-grounds." I need not go into the details of these deposits, nor of those in other places containing the great Mammals which must have been contemporary with "Tertiary Man," for I should only weary the reader with a monotony of abnormal conditions of deposit — unlike anything now being produced this wide world over. We shall be stating the case very mildly indeed, if we conclude that the vast majority of the fossils, by their profuse abundance and their astonishing preservation, tell a very plain story of "speedy burial after death," and *are of an essentially different character from modern deposits.*

Professor Nicholson, in speaking of the remains of the Zeuglodon, says:

> Remains of these gigantic Whales are very common in the "Jackson beds" of the Southern United States. So common are they that, according to Dana, "the large vertebræ, some of them a foot and a half long and a foot in diameter, were formerly so abundant over the country in Alabama that they were used for making walls, or were burned to rid the fields of them."—*"Ancient Life-History," p. 300.*

Shortly before his death in 1895, Dana prepared a revised edition of his "Manual," and in it he gives us quite a rational explanation of this case, as follows:

> Vertebræ were so abundant, on the first discovery, in some places that many of these Eocene Whales must have been stranded together in a common catastrophe, on the northern borders of the Mexican Gulf — possibly by a series of earthquake waves of great violence; or by an elevation along the sea limit that made a confined basin of the border region, which the hot sun rendered destructive alike to Zeuglodons

and their game; or by an unusual retreat of the tide, which left them dry and floundering under a tropical sun.— *P. 908.*

That is, this veteran geologist in his old age would not attempt to account for such abnormal conditions without a catastrophe of some kind. But if we use similar explanations for similar conditions, where shall we stop through the whole range of the rocks from the Cambrian to the Pleistocene?

Dana became very fond of this idea of earthquake waves, and invoked them to account for "the universality and abruptness" with which the species disappear at the close of "Palæozoic time," using as the generating cause the uplifting of the Appalachian Mountains, with "flexures miles in height and space, and slips along newly opened fractures that kept up their interrupted progress through thousands of feet of displacement," from which he says "incalculable violence and great surgings of the ocean should have occurred and been often repeated. . . . Under such circumstances the devastation of the sea border and the low-lying lands of the period, the destruction of their animals and plants, would have been a sure result. The survivors within a long distance of the coast line would have been few." ("Manual," p. 736.)

But as this sudden break in the life-chain "was so general and extensive that no Carboniferous species is known to occur among the fossils of succeeding beds, not only in America and Europe, but also over the rest of the world" (p. 735), he is obliged to make his catastrophe by earthquake waves

*positively world-wide.* Hence he adds, "The same waves would have swept over European land and seas, and there found coadjutors for new strife in earthquake waves of European origin."

At the close of the Mesozoic he uses similar language, though in this case he has the whole range of the mountains on the west of both North and South America, the Rockies and the Andes, in length a "third of the circumference of the globe," "undergoing simultaneous orogenic movements, with like grand results." (P. 875.) "The deluging waves sent careering over the land" would, he thinks, "have been destructive over all the coasts of a hemisphere," and "may have made their marches inland for hundreds of miles" (p. 878), sweeping all before them.

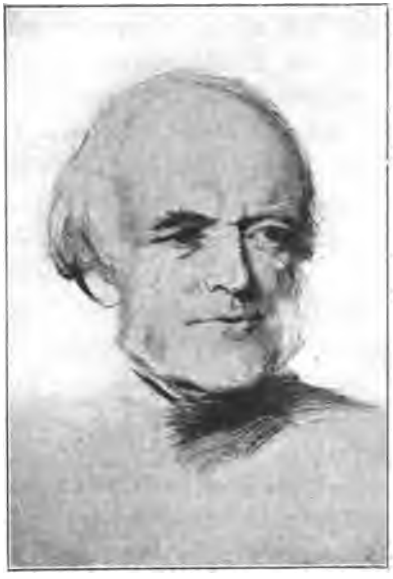


FIG. 30 — SIR CHARLES LYELL (1797-1875)

I should think so; but then *what becomes of this doctrine of uniformity?* Personally, I have not the slightest objection to these "deluging waves sent careering over the land," for I feel sure that just

such things have occurred, and on just such a scale as our author pictures, for, as he says, the destruction of species "was great, world-wide, and one of the most marvelous events in geological history."[1] (P. 877.)

But it seems to me that here we have an enormous amount of energy going to waste. Others have demanded a continent to explain the appearance of a beetle in a certain locality; but here we have a great world-wide catastrophe to explain the sudden disappearance of merely a few species. Why not utilize this surplus energy in doing other necessary work, that has certainly been accomplished somehow, but has hitherto gone a begging for a competent cause? The only thing I object to in Dana's view

FIG. 31 — JAMES HUTTON (1726-1797)

[1] Prof. Eduard Suess, with his usual transparent candor, when referring to the work of Sir John Murray in proving that the deposits now gathering at the bottom of our modern oceans contain no gravel, or sand, or clay, or any "admixture of mineral matter derived from the surface of the land," points out how sharply they contrast with the old-time geological deposits. And in speaking of the manner in which some at least of the geological changes must have occurred, he says that many of them must have been "of such indescribable and overpowering violence that the imagination refuses to follow the understanding and to complete the picture" of how they were really accomplished. ("Face of the Earth," Vol. 1, pp. 4, 17, 18.)

of the case is his way of having these "exterminations" take place on the instalment plan. For in that way we have to work up a great world catastrophe to do only a very limited amount of work, and then have to repeat the thing another time for a similarly limited work, *when one such cosmic convulsion is competent to do the whole thing.* I plead for the "law of parsimony," and the economizing of energy.

As Sir Isaac Newton expressed it in his *Regulæ Philosophandi,* "No more causes are to be admitted than such as suffice to explain the phenomena;" and also, "In so far as possible, the same causes are to be assigned for the same kind of natural effects."

It will never do to disregard continually these simple axioms of inductive reasoning, if we expect our geology to rank with the other sciences founded on the principles of induction.

The vast shoals of carcasses which seem to be piled up in almost every corner of the world are *prima facie* evidence that our old globe has witnessed some sort of cosmic convulsion. The exact cause, nature, and extent of this event we may never have sufficient facts to determine, though two or three additional facts having a bearing on the subject will be considered in the following chapters.

# CHAPTER X

## Change of Climate

ANOTHER great general fact about the fossil world may be stated about as follows:

*All of the fossils* (save a very few of the so-called "Glacial age," and they admit of other easy explanation) *give us proofs of an almost eternal spring having prevailed in the Arctic regions, and semitropical conditions in north temperate latitudes; in short give us proofs of a singular uniformity of climate over the globe which we can hardly conceive possible, let alone account for.*

The proofs of this are almost unnecessary, as this subject of climate has been pretty well discussed of late years. And it was the overwhelming evidence on this point which forced Lyell and so many others to decide against the theory of Croll, which called for a regular rotation of climates, for they said that the fossil evidence was wholly against such a view. Howorth has given an admirable argument on this point in chapter 11 of his second work on the Glacial theory ("The Glacial Nightmare and the Flood," pp. 426-479), and to it I would refer the reader for details which I have not the space to reproduce here.

This author first remarks:

The best thermometer we can use to test the character of a climate is the flora and fauna which lived while it prevailed. This is not only the best, but is virtually the only thermometer available when we inquire into the climate of past geological ages. Other evidence is always sophisticated by the fact that we may be attributing to climate what is due to other causes, boulders can be rolled by the sea as well as by subglacial streams, and conglomerates can be formed by other agencies than ice. But the biological evidence is unmistakable; cold-blooded Reptiles can not live in icy water; semitropical plants, or plants whose habitat is in the temperate zone, can not ripen their seeds and sow themselves under Arctic conditions. . . . We may examine the whole series of geological horizons, from the earliest Palæozoic beds down to the so-called Glacial beds, and find, so far as I know, no adequate evidence of discontinuous and alternating climates, no evidence whatever of the existence of periods of intense cold intervening between warm periods, but just the contrary. Not only so, but we shall find that *the differentiation of the earth's climate into tropical and Arctic zones is comparatively modern*, and that in past ages not only were the climates more uniform, but more evenly distributed over the whole world.

Without attempting to follow through the whole series of formations, we may note a few characteristic statements of the text-books. Thus Dana says of the Cambrian:

There was no frigid zone, and there may have been no excessively torrid zone.

While of the Silurian coral limestones of the Arctic regions he says:

The formation of thick strata of limestone shows that life like that of the lower latitudes not only existed there, but flourished in profusion.—*"Manual," pp. 484, 524, 525.*

Howorth thus quotes Colonel Fielden, the Arctic explorer, regarding the fossil Sclerodermic Corals of the Silurian, widely distributed in the Arctic regions:

> These undoubted reef-forming Corals of the Silurian epoch were just as much inhabitants of warm water in northern latitudes at that period as are the Sclerodermata of to-day in the Indo-Pacific and Atlantic oceans. . . . These Corals were forms of life which must have been tropical in habits and requirement.

In fact coral limestones of the Carboniferous system are the nearest known fossiliferous rocks to the north pole, and from the strike of the beds must underlie the Polar Sea. In the words of Howorth, "Coal strata with similar fossils have occurred all round the polar basin, . . . and may be said, therefore, to have occupied a continuous cap around the north pole." (*Op. cit.*, pp. 434, 435.)

Again I quote from Howorth regarding the Mesozoic rocks:

> This very wide-spread fauna and flora proves that the high temperature of the Secondary era prevailed in all latitudes, and not only so, it pervaded them apparently continuously without a break. There is no evidence whatever, known to me, that can be derived from the fauna and flora of Secondary times, which points to any period of cold as even possible. There are no shrunken and stunted forms, and no types such as we associate with cold conditions, and no changes evidenced by intercalated beds showing vicissitudes of life.

The following is from Nordenskiöld, as quoted by Howorth, and refers to the whole geological series:

From what has been already stated it appears that the animal and vegetable relics found in the polar regions, imbedded in strata deposited in widely separated geological eras, *uniformly testify that a warm climate has in former times prevailed over the whole globe.* From palæontological science no support can be obtained for the assumption of a periodical alternation of warm and cold climates on the surface of the earth.— *Id., p. 45.*

And now we have the equally positive language of A. R. Wallace:

It is quite impossible to ignore or evade the force of the testimony as to the continuous warm climate of the north temperate and polar zones throughout Tertiary times. The evidence extends over a vast area both in space and time, it is derived from the work of the most competent living geologists, and it is absolutely consistent in its general tendency. . . . Whether in Miocene, Upper or Lower Cretaceous, Jurassic, Triassic, Carboniferous, or Silurian times, and in all the numerous localities extending over more than half the polar regions, we find *one uniform climatic aspect of the fossils.*—*"Island Life," pp. 182, 195, 196; "Nightmare," pp. 455, 456.*

Of course in all this I am taking the various kinds of fossils in the traditional chronological order. But I shall presently show on the best of authority that Man existed in "Pliocene" or perhaps "Miocene times," and in view of such an admission we have, even from the standpoint of current theory, a vital, personal interest in this question of climate. Let us take, then, the following from James Geikie, the great champion of the Glacial theory, on the climate of the Arctic regions at this part of *the human epoch:*

Miocene deposits occur in Greenland, Iceland, Spitzbergen, and at other places within the Arctic Circle. The beds contain a similar [similar to the "most luxuriant vegetation"

of Switzerland] assemblage of plant remains; the Palm-trees, however, being wanting. It is certainly wonderful that within so recent a period as the Miocene, a climate existed within the Arctic regions so mild and genial as to nourish there Beeches, Oaks, Planes, Poplars, Walnuts, Limes, Magnolias, Hazel, Holly, Blackthorn, Logwood, Hawthorn, Ivy, Vines, and many evergreens, besides numerous Conifers, among which was the Sequoia, allied to the gigantic *Wellingtonia* of California. This ancient vegetation has been traced up to within eleven degrees of the pole.—*"Historical Geology," p. 76.*

According to Dana and other American geologists the "Glacial period" is only a variation intervening between the warm Tertiary and the equally warm "Champlain period," and it was during the latter that the Mammoth, Mastodon, etc., roamed over Europe, Asia, and America. Of the climate then indicated, when all acknowledge that Man was in existence, this author says:

The genial climate that followed the Glacial appears to have been marvelously genial to the species, *and alike for all the continents, Australia included.* The kinds that continued into modern time became dwindled in the change wherever found over the globe, notwithstanding the fact that genial climates are still to be found over large regions.—*"Manual," p. 997.*

In his "Geological Story Briefly Told," he uses even stronger language:

The brute Mammals reached their maximum in numbers and size during the warm Champlain period, and many species lived then which have since become extinct. Those of Europe and Britain were largely warm-climate species, such as are now confined to warm temperate and tropical regions; and only in a warm period like the Champlain could they have thrived and attained their gigantic size. The

great abundance of their remains and their condition show that the climate and food were all the animals could have desired. They were masters of their wanderings, and had their choice of the best.— *Page 225, ed. of 1875.*

The genial climate of the Champlain period was *abruptly* [Italics Dana's] terminated. For carcasses of the Siberian Elephants were frozen so suddenly and so completely at the change, that the flesh has remained untainted.— *Id., p. 230.*

I quite agree with this author that the evidence is conclusive as to the climate and food being "all the animals could have desired," and that they must have "had their choice of the best." But it seems to me that in following out their theory these authors have not left the poor creatures very much to choose from. For as the inevitable result of their theory in arranging the plants as well as the animals in chronological order according to the percentages of living and extinct forms, they have already disposed of, and consigned to the "early" Tertiaries, etc., all the probable vegetation on which these animals lived, and thus have nothing left on which to feed the Rhinoceros, Elephant, etc., away within the Arctic Circle, except a few miserable shrubs and lichens which now survive there.

But this strange, inconsistent notion of Dana's that the so-called Glacial phenomena lie in between the warm Tertiary and the equally warm "Champlain period," is easily understood as the survival f the notion, so tenaciously held even later than the middle decades of the nineteenth century, that Man was *not* a witness of any of the great geological changes. When the evidence became overwhelming

that Man lived while the semitropical animals roamed over England, the "Glacial period" still remained as a sort of buffer against the dangerous possibility of extending the human period back any further. I am not aware that this venerable scientist ever became quite reconciled to the idea of "Tertiary Man," though in his "Manual" he mentions a few evidences in favor of this now almost universally accepted opinion.

As for the real teachings of the Drift phenomena, there is no need of explanation here. At the very most they are confined to a quite limited part of the northern hemisphere, there being no trace of them in Alaska, nor on the plains of Siberia, where now almost eternal frosts prevail.[1] In fact they are practically confined between the Rocky Mountains and the Missouri River on the west, and the Ural Mountains on the east; and with a little common sense infused into the foundation principles of the science, we shall cease to be tormented with a "glacial nightmare." Much of the Drift phenomena with the raised beaches are certainly *later* events than most of the other geological work, but are inseparably connected with the general problem in their explanation.[2] Even from the ordinary view-point, I am not aware that the elaborate argument of Ho-

[1] See Dana's "Manual," pp. 945, 977; also "The Glacial Nightmare," pp. 451, 452, 511, etc.

[2] I have left this statement exactly as it appeared in the first edition. But it is interesting to note how this opinion of the inseparable connection with the other geological changes of the ancient shore-line around all the continents is supported by Eduard Suess. See "The Face of the Earth," Vol. 2, pp. 497, 550, 554.

worth has ever been satisfactorily answered. Indeed, I feel almost like saying that this writer's various contributions to the cause of inductive geology mark the beginning of the dawn.

Hence it may suffice here to call attention merely to the great simplicity introduced into this vast complexity of the glacialists, by the positive assurance of this author that the "Drift period" and the Pleistocene end together, and join onto the modern; or perhaps I should say that the so-called Glacial phenomena *lie in between the true fossil world and our modern one.*

Thus, in regard to the Pleistocene Mammals, the view is now generally accepted that, in every place where they have been found in a contemporary bed, that bed underlies the till, and is therefore preglacial. As in other places, so here [Scotland], teeth and bones of Mammals have occurred in the clay itself; but in all such cases they occur sporadically and as boulders. As Mr. James Geikie says, "They almost invariably afford marks of having been subjected to the same action as the stones and boulders by which they are surrounded; that is to say, they are rubbed, ground, striated, and smoothed."—*"Great Ice Age," p. 129; "Nightmare," p. 473.*

And again:

*The Pleistocene fauna, so far as I know, came to an end with the so-called Glacial age.—Id., p. 463.*

From a recent notice in *Nature*[3] it would seem that even Dr. H. Woodward, of the British Museum, supports this general view in his "Table of British Strata," by the statement that the Glacial deposits contain *only derived fossils.*

[3] See *Nature,* April 11, 1901, p. 560.

But this is so decided a simplification of the problem of climate that I am utterly at a loss to understand how any one can still cling to the complex and highly artificial arrangement of numerous "interglacial" periods, to account for a few bones of Mammals or a few pockets of lignite; and how they can even place between the "Glacial period" and our times the "genial Champlain period," with it, as Dana says, "*abruptly terminated,*" and becoming "*suddenly* extreme as of a single winter's night." Howorth, in the latter part of the chapter already quoted from (pp. 460-478), gives a good review of this subject of intermittent climates, and strongly supports his contention that the stratigraphical evidence all points to the fact that the Pleistocene forms are always older than the Drift-beds, and where the flora and fauna of the Pleistocene occur in the Drift, they do so only as boulders; that, in fact, as he says in his preface, "The Pleistocene Flood . . . *forms a great dividing line* in the superficial deposits," separating the true fossil world from the modern. But when this much is settled, the rest becomes very easy.

I have hardly the space to repeat here my argument about the extremely fanciful way in which geologists classify the various members of the Tertiary group and the Pleistocene. And yet I must say a few words. I have tried to show the utter nonsense of the common custom of classifying these beds according to the percentage of living and extinct forms which they contain, when the real fact is

that the number and kinds of the ancient life forms which have survived into the modern era is a purely fortuitous circumstance, being limited solely to those lucky ones which could stand the radical change from a tepid water or a genial air to the ice and frosts which they now experience, to mention only one circumstance of that cosmic convulsion which we now know to have really intervened between that ancient world and our own. YET IT IS ON SUCH EVIDENCE ONLY that these Pleistocene forms are separated from the Tertiaries, or that the Tertiaries themselves are classified off — at least so far as the Invertebrates and the plants are concerned. No one claims that the so-called Glacial beds can be sharply distinguished from other deposits on purely mechanical make-up. Indeed, I am strongly of the opinion that very many Archæan soils, totally unfossiliferous themselves, and resting on unfossiliferous rocks, have been assigned to the "Glacial age" merely because their discoverers did not know what else to do with them. When beds contain fossils, the latter are the one and only guide in determining age; but in view of the purely arbitrary character of this method of classifying off the Tertiary and Post-Tertiary rocks, I do not see where we are going to draw the line when we once admit that the Post-Tertiary beds contain only "derived fossils." It seems to me truly astonishing that shrewd reasoners, like Howorth and Dr. Woodward, have not seen the dangerous character of this precedent which they have admitted. For with that marvelous climate of all geological

time continuing right up to that fatal day when it was "abruptly terminated," and the Mammoth and his fellows were caught in the merciless frosts which now hold them, the percentage of all the lucky forms of life, plants, Invertebrates, or Mammals, which could stand such a change and "persist" into our modern world, must be utterly nonsensical as a test of age even from their standpoint.

In resuming the main argument of this chapter, I need only summarize by saying that the evidence is conclusive that all geological time down to this "great dividing line" was characterized by a surprisingly mild and uniform climate over all the earth, for there is only one climate known to geology proper. The modern period is characterized by terrific extremes of heat and cold; and now little or nothing can exist where previously plant and animal life flourished in profusion.

This radical and world-wide change in climate, therefore, demands ample consideration when seeking a true induction as to the past of our globe. That it was no gradual or secular affair, but that the climate "became suddenly extreme as of a single winter's night," the Siberian "mummies" are unanswerable arguments. *That it occurred within the human epoch all are now agreed.*

# CHAPTER XI

## Degeneration

There is another great general fact about the fossil world which seems to be a natural corollary from the one already given about climate.

It is this:

*The fossils, regarded as a whole, invariably supply us with types larger of their kind and better developed in every way than their nearest modern representatives, whether of plants or animals.*

This fact also is so well known that it needs no proof. Through the whole range of geological literature I do not know of a word of dissent from this general fact by any writer whatever. Proof therefore is not necessary, though a brief review of a little of the evidence may refresh our memories.

And the point to be especially noted here is that this remarkable peculiarity is characteristic of *all* the fossils; whereas when we cross over into our modern era *the change is just as sudden and complete as is that of climate.* Our modern plants and animals, whether in the sea or on the land, are degenerate dwarfs.

To begin with the Cambrian, Dana says:

The Pteropods, among Mollusks, were much larger than the modern species of the tribe. The Trilobites even of the

Lower Cambrian comprise species as large as living Crustaceans. The Ostracoids are generally larger than those of recent times.—"*Manual,*" *p. 487.*

Again, in speaking of the general character of the Cambrian fossils, he says:

The types of the early Cambrian are mostly identical with those now represented in existing seas, and although inferior in general as to grade [in the "phylogenic series"], they bear no marks of imperfect or stunted growth from unfit or foul surroundings.—*P. 485.*

The well-known Mollusk, *Maclurea magna,* which is so enormously abundant in the Silurian, is often eight inches in diameter; and the astounding Cephalopod genus, *Endoceras,* consisting of twenty species, found only in two divisions of the Lower Silurian, has left shells over a foot in diameter and ten or twelve feet long!

Of the Fishes of the Devonian we have, among other remarks of a similar character, the following:

The Dipnoans, or "Lung-fishes," were represented by gigantic species called by Newberry *Dinichthys* and *Titanichthys,* from their size and formidable dental armature. . . . A still larger species is the *Titanichthys clarki* of Newberry, in which the head was four feet or more broad, the lower jaw a yard long. This jaw was shaped posteriorly like an oar blade, and anteriorly was turned upward like a sled runner.—*Pp. 618, 619.*

One of the ancient Eurypterids from the Old Red Sandstone of Europe has a length of six feet, which is more than three times that of any Crustacean now living; while a gigantic Isopod Crustacean from the same strata had a leg the basal joint of which was three inches long, and three quarters of

an inch through, which is larger than the whole body of any modern species.

The ancient "Horsetails," "Ground-pines," Ferns, and Cycads were trees from thirty to ninety feet high, and their carbonized stems and leaves make up many of our largest and best beds of coal. Compared with them the modern representatives are mere herbs or shrubbery.

Of the gigantic Insects of the Devonian and Carboniferous beds we might make similar remarks. Some of the ancient Locusts had an expanse of wing of over seven inches; while many of the ancient Dragon-flies had bodies from a foot to sixteen inches long, with wings a foot long and over two feet in spread from tip to tip.

Here is James Geikie's summary of the leading types of the Palæozoic:

> Many Palæozoic species were characterized by their large size as compared with species of the same groups that belong to later times. Thus, some Trilobites and other Crustaceans were larger than any modern species of Crustaceans. The Palæozoic Amphibians also much exceed in size any living members of their class. Again, the modern Club-mosses, which are insignificant plants, either trailing on the ground or never reaching more than two feet in height, were represented by great lepidodendroid trees.

Sternberg, in speaking of some of the Frogs which he found in the Permian of Texas, says:

> I found several skulls that measured over a foot from the end of the chin to the distal point of the horns. . . . I think when alive the Frog must have been six feet long.—*"Popular Science News," May, 1902, p. 106.*

He mentions another specimen which was "about

ten feet long," the head of which was "about twenty inches in length," with jaws "more powerful than those of an Ox."

Of the monstrous Dinosaurs of the Mesozoic rocks one hardly needs to speak.

> They were the most gigantic of terrestrial animals, in some cases reaching a length of 70 or 80 feet, while at the same time they had a height of body and massiveness of limb that, without evidence from the bones, would have been thought too great for muscle to move.—*Dana, "Manual," p. 761.*

They abound in both the Old and the New World.

Of the gigantic Mammals of the Tertiary beds of the Western States, it would also be superfluous to speak; their gigantic size is known by every high school pupil, or every one who has visited any important museum in Europe or America.

We may perhaps be reminded again that all the species of these "older" rocks are extinct species. I have already suggested the grave doubts on this point, regarding the great mass of the lower forms of life (pp. 125-144), plant and animal; but we will let that pass. But let us take some of the "late" Tertiary and Pleistocene Mammals, which can not be distinguished from living species, and how do we fare? It is the same old story; the moderns are degenerate dwarfs.

The Hippopotamus (*H. major*) is a good one to start with, for Flower and Lydekker[1] say that it "can not be specifically distinguished from *H. amphibius*" of Africa. This gigantic brute used to live

[1] "Mammals," etc., p. 281.

in the rivers of England and Western Europe. The text-books generally say in "Pliocene times," because, I suppose, no one has the courage to suggest that it lived under the ice of the "Glacial period." We are always pointed to the wool on the Rhinoceros and the Mammoth as indicating a somewhat cool climate, but the well-known amphibious habits of the Hippopotamus can not be so easily disposed of. But if, as I believe, this world never saw a foot of ice at the sea-level till the end of the "Pleistocene period," to speak after the current manner, the problem becomes very simple. In that case the time of the Hippopotamus in England was neither earlier nor later than that of the Palms and Acacias of the "early" Tertiary or Mesozoic rocks, or than that of the Mammoth, Lion, and Hyena of the Pleistocene. There is, as we now know, absolutely nothing but an out-of-date hypothesis to indicate that they did not all live there together. We may, if we choose, try to dovetail those conditions into the present on the basis of uniformity and slow secular change, by assuming a few million years for the process, but there is not a particle either of evidence or of probability that the Hippopotamus was not contemporary alike with the Palms of the Eocene and the Elephants and Lions of the Post-Tertiary.

As for the Mammoth itself, which Flower and Lydekker have intimated may turn out identical with *E. columbi* and *E. armeniacus,* and thus the direct ancestor of the modern Asiatic Elephant (*E. indicus*), some have argued that its average size was

not greater than that of the existing species of India and Africa. But Nicholson says that it was "considerably larger than the largest of living Elephants, the skeleton being over sixteen feet in length, exclusive of the tusks, and over nine feet in height." ("Ancient Life-History," p. 357.)

Dana is equally positive:

> The species was over twice the weight of the largest modern Elephant, and nearly a third taller.—*"Manual," p. 998.*

The upper incisors or tusks were very much longer than in the modern species, being from ten to twelve feet long, and sometimes curved up and back so as to form an almost complete circle. As these tusks continue to grow throughout life, their enormous length is, I take it, a proof of much greater longevity and thus of greater vitality than in the case of the modern species. The latter is simply a degenerate.

And so I might go on with the Edentates, the Ungulates, the Rodents, the Carnivores, etc., for the same thing must be said of all.

As Sir William Dawson remarks:

> Nothing is more evident in the history of fossil animals and plants of past geological ages than that *persistence or degeneracy is the rule* rather than the exception. . . . We may almost say that all things left to themselves *tend to degenerate,* and only a new breathing of the Almighty Spirit can start them again on the path of advancement.—*"Modern Ideas of Evolution," Appendix.*

In spite of the long popular views of Cuvier, every modern scientist admits that the great Lion

and Hyena of the Pleistocene are identical with the living species of Africa. Many say the same thing of the fossil Bear as compared with the modern Brown Bear and the Grizzly, though, as Dana remarks of all three, Lion, Hyena, and Bear, "these modern kinds are dwarfs in comparison."

I quote again from Dana:

> Thus the brute races of the Middle Quaternary on all the continents exceeded the moderns greatly in magnitude. Why, no one has explained.—*"Geological Story Briefly Told," p. 229.*

This was in 1875. In the last edition of his "Manual," published shortly after his death, he has this to say in addition:

> A species thrives best in the region of fittest climate. *In the Pleistocene, the fittest climate was universal.* Geologists have attributed the extinction of most of the species and the dwindling of others to the cold of the Reindeer epoch. It is the only explanation yet found, though seemingly insufficient for the Americas.—*P. 1016.*

However, since the discovery of the pictures of the Reindeer and the Mammoth drawn and even painted side by side on the caverns of Southern France (Figs. 32-35), undoubtedly from life and by the same artist, we do not hear so much about the "Reindeer epoch" and the "Mammoth epoch." A little thought should have suggested long ago that it was more reasonable to suppose the Reindeer, Glutton, Musk-ox, etc., to have been originally adapted to the high mountains and table-lands of that ancient world, than to imagine all the fauna careering up and down over continents and across

seas like a lot of crazy Scandinavian Lemmings, as the migration theory involved. But most geologists seem never to have had any use for mountains or plateaus, except to breed glaciers and continental ice-sheets. But the only point which I wish to insist upon here is that the cause, whatever it was, that made such a zoological break at the "close" of the Pleistocene, and which compelled the shivering, degenerate survivors, that could not stand the new extremes of frost and snow, to shift to the tropics — this cause was certainly competent to do a good deal more work in the way of "extinction" or "dwindling" of species than the uniformitarians have generally given it credit for.

And in summing up this matter regarding the size and physical development of species, we must confess that we find in geology no indication of inherent progress upward. Variation there is and variation there has been, perhaps even "mutations" and "saltations" that seem like the origin of veritable "new species"; but with one voice do the rocks testify that the general results of such variation have not been upward. Rather must we confess as a great biological law, that *degeneration has marked the history of every living form.* But even more important is the fact that this change from the larger ancient forms to the smaller modern ones *is abrupt and complete over the whole globe,* and coincides exactly with the change from the fossil world to the modern one.

# CHAPTER XII

## Fossil Men

THERE is still another fact which we must consider ere we can frame any wise or safe induction regarding the geological changes. It is this:

*Man himself, to say nothing of numerous living animals and plants, must have witnessed something of the nature of a cosmic convulsion — how much, it is the object of our search to find out.* Even according to the ordinary text-books, he must have seen the uplifting of the greater part of the mountain chains of the world; while he certainly lived in conditions of climate, and of land and water distribution, together with plant and animal surroundings, which preclude the possibility of dovetailing those conditions into the present order of things on any basis of uniformity.

By this proposition I simply mean that Man must have witnessed a cosmic geological catastrophe of some character and of some dimensions. The true nature and probable limits of this catastrophe ought to be the chief point of all geological inquiry. But instead of this method — instead of finding out whether our present world was ever a witness of such an event — the founders of the science began at the little end of an assumed succession of life (involving

a preposterous supernatural knowledge of the past), and gradually worked up a habit of explaining everything in terms of uniformity long decades before they would acknowledge that Man or the present order of things had anything to do with this fossil world. The evidence on this latter point finally became overwhelming; but with their habit of uniformity well mastered, and their long, single file of life succession all tabulated off and infallibly fixed, modern geologists have hitherto refused to look at the whole science from this new point of view, or to reconstruct geological theory if need be in accordance with a true modern induction.

This problem regarding prehistoric Man,— the length of time he has been on earth, his condition at the beginning, and his relation to the great world changes that have unquestionably taken place since he came into existence,— has long been regarded as one of the most perplexing in the whole realm of science. For decades the world was agitated over the problem of the origin of races, whether Man originated from one race or several. Aristotle and the other ancients had considered it a very simple thing to account for the different races of mankind by the effects of climate, food, occupation, and such things. But our more precise modern knowledge has taught us that the problem is not by any means so easy. These influences are now known to be so slight in amount and so slow in operation that it becomes almost a hopeless task to account for the diversities of the various races in any reasonable amount of

time by these agencies alone and without some abrupt change that could be little short of miraculous. This line of argument finds support in the remarkable permanence of type displayed by various races after being transplanted to other climates and other habits of life. Again, peoples like the Bushmen and Negroes may live for long periods side by side under the same conditions of climate without becoming in any way more alike. On the other hand, the forest tribes of tropical Brazil show a striking resemblance to the coast tribes of Terra del Fuego, in spite of extreme differences in climate and food. Last of all, the monuments of Egypt show that back at the very dawn of history the various races were apparently just as distinct as to-day in color, hair, and features. All of these things have made it hard to understand how such diverse races as the Negro, the Mongolian, and the Caucasian could possibly be derived from a common stock without something very much like a miracle. Philology, or the study of languages, has given us about the same result; for fifty or seventy-five distinct types of language have been made out, such that no one kind can be considered to be derived from any other, and yet we can not understand how a language can ever be so completely transformed from within as to lose its original roots entirely, and even change its entire plan of structure. But in spite of all these considerations, the unity of the human race is much more generally accepted now than ever before. The popular geological notions have made people familiar

with the idea of almost unlimited periods of time, and in this, as in geology proper, scientists have tried to persuade themselves that a greatly extended period of time might help to solve the problem.

As already remarked, Cuvier and his followers not only denied that human remains are ever found

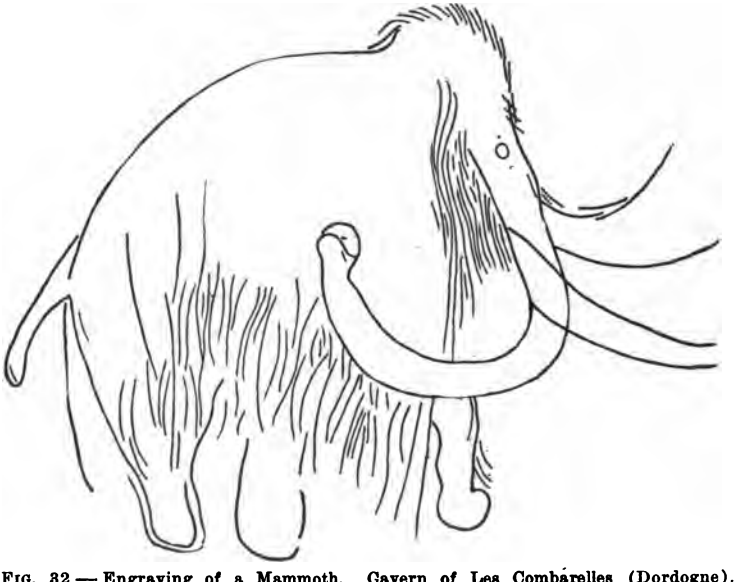


FIG. 32 — Engraving of a Mammoth. Cavern of Les Combarelles (Dordogne). 1-7. (After Capitan and Breuil.)

fossil, but denied most positively that any living species is to be found in the fossil state. The earliest reports of human remains being found in geological deposits, as given by Tournal and Christol in 1828, by Schmerling in 1833, or even those of M. Boucher de Perthes in 1841-1847, were largely ignored; but from this point onward the French and

the English geologists began to consider the matter more carefully, and they found irresistible evidence that Man lived contemporary with the Pleistocene or Post-Tertiary animals. Godwin-Austen, as early as 1840, had described human remains found mixed up with those of the Mammoth, Rhinoceros, etc., in Kent's Cavern, England; and a few years later similar cave deposits were discovered in France, culminating in the sensational find of Lartet and Christy (1865) of some drawings of Reindeer on a piece of horn, and a sketch of a Mammoth, showing the Elephant's tusks and long hair, on a piece of Mammoth's tusk from La Madeleine. From this point the work of discovery has gone steadily forward until to-day no intelligent man denies that human remains have been found in deposits which geologists classify as Pleistocene, Pliocene, and in some cases even Miocene.

Now, suppose it is settled by indisputable facts than Man was contemporary with the animals of the Middle Tertiary rocks. I am aware that a few scientists still refuse to believe in "Tertiary Man," and I admit that most of the rude stone implements commonly relied upon to prove Man's existence at that "period" are far from convincing. But I have little doubt that bones and other unequivocal human remains have been found or may at any time be found in beds containing Pliocene or Miocene fossils.

But in this fact, if it be a fact, that Man lived under the wholly strange and different conditions of "Pliocene" or perhaps "Miocene times," is THE

VERY STRONGEST POSSIBLE ARGUMENT that I can conceive of for the necessity of a complete reconstruction of geological theory — I mean, of course, apart altogether from the preposterous way in which the life succession was assumed and built up and then treated as an actual fact. It was when this grim fact of Man's inseparable connection with the fossil world was borne in upon me, that I began to realize the possibility and imperative necessity of reconstructing the science on a truly inductive basis.

I shall not undertake to give a complete up-to-date argument for "Miocene" or even "Pliocene Man." The subject is still under discussion as to *just how far back,* along this thin line of receding life forms, Man actually did live; and from the peculiar methods now in vogue, which are wholly subjective in character, it would seem to be capable of settlement in almost any way one chooses. Thus, a very high authority, in speaking of the river terraces in which these most ancient human remains are found, remarks, "It is by no means easy, in the present state of the land surface and with our present knowledge, to place the remains in their relative sequence." ("Encyclopædia Britannica," Vol. 2, p. 246, Cambridge University ed.) However, whole volumes are being written on the subject, and the end is not yet. But there is no denying that human remains have frequently been found in strata which, but for their presence, would have been assigned a place far back in "Tertiary time." The existence of strong evi-

dence for "Tertiary Man" no one would think of denying.

In all this, of course, I am considering the question from the common uniformitarian standpoint. But why should it be necessary for us to settle positively the question as to just how far back in "geological time" Man actually did live? For those who have attentively read my statement of the unscientific methods of classifying these Tertiary and Post-Tertiary beds — or all the others, for that matter — I need not here add any further argument. If the accepted succession of life is, to put it as mildly as possible, not quite a scientific certainty; if the time-honored custom of classifying these so-called "superficial" beds by their relative percentages of extinct and living forms rests under a shadow of suspicion as to its scientific accuracy; if, above all, we do not at the beginning prejudice the whole case by the assumption of uniformity, *what need is there of determining whether "Pliocene" or "Miocene" shells are found with these fossil human remains?* What material difference can it make, in a serious, scientific treatment of this problem, whether five per cent or twenty-five per cent or ninety-five per cent of the associated Mollusks belong to "species" classed as "extinct"?

That Man lived in Western Europe contemporary with those giants of the prime, the Elephant and the Musk-ox, the Rhinoceros and the Reindeer, the Lion, the Cape Hyena, and the Hippopotamus, at which time a very different distribution of land and

water prevailed over these parts, with a radically different mantle of climate spread over all, no one will deny for a moment. Such facts are now found in the primary text-books for our children in the public schools.

But since geologists still classify the rocks as they do, and give a time value to percentages of extinct and living species of marine shells, etc., we are in a measure compelled to take the matter where we find it, and inquire, How far back in geological time — that is, among what kinds of fossils — are human remains found?

One of the best popular works on the subject that I know of is "The Meeting-Place of Geology and History" (1894), by Sir J. W. Dawson; though, like all other works of its kind written from the religious standpoint, it endeavors as far as possible to minimize the evidence in support of Man's geological antiquity.

This author thinks that Dr. Mourlan, of Belgium, has "established the strongest case yet on record for the existence of Tertiary Man." (P. 30.) It is that of some worked flints and broken bones of animals "imbedded in sands derived from Eocene and Pliocene beds, and supposed to have been remanié by wind action." Prestwich[1] has brought forward similar facts; and though the evidence in favor of the genuine geological character of these remains seems to me little if any better than that

[1] "Controverted Questions of Geology," Article 3, 1895.

from the auriferous gravels of California, I am willing to take them as reported.

Dawson speaks of the nearly entire human skeleton described by Quatrefages from the Lower Pliocene beds of Castelnedolo, near Brescia, and only answers it with a sarcastic remark about the well-developed skull of this ancient man.

> Unfortunately the skull of the only perfect skeleton is said to have been of fair proportions and superior to those of the ruder types of Post-Glacial men. This has cast a shade of suspicion on the discovery, especially on the part of evolutionists, who think it is not in accordance with theory that Man should retrograde between the Pliocene and the early modern period instead of advancing.—*"Meeting-Place," pp. 28, 29.*

Lastly, we have the following about the Miocene:

> There are, however, in France two localities (Puy-Courny and Thenay), one in the Upper and the other in the Middle Miocene, which have afforded what are supposed to be worked flints.

He adds that "the geological age of the deposits seems in both cases beyond question;" but contents himself with a derisive answer about these chipped flints being possibly "the handiwork of Miocene apes."

This language, coming from such a source, would seem as good evidence as is needed to prove that Man was contemporary with, and that his remains are now found among the fossils of, the Middle Miocene. For it must be remembered that these are reluctant admissions drawn from this illustrious scientist, who was one of the last champions of the old ideas about

the "recent" origin of Man. As President Asa Mahan of Cornell has said, "Admissions in favor of truth from the ranks of its enemies constitute the highest kind of evidence." At any rate, I shall treat this point as already proved, *for whether this particular instance is accepted or not, practically all modern writers admit the fact of "Middle Tertiary Man."*

Reference has already been made to the very remarkable carvings and paintings on the cave walls of Southwestern Europe. They have been discovered quite generally throughout all this region, and usually consist of carvings of Reindeer, Aurochs, Horses, Mammoths, and various other animals, often life-size, and painted in the most astonishing and realistic manner. Scientists are universally agreed as to their great antiquity, for they argue that they must have been done by men familiar with the forms depicted, and hence the period of time must have been when the Reindeer and the Elephant lived side by side in France and Spain. Besides, the drawings are sometimes covered with limestone stalactites two inches or more thick. The Marquis de Nadaillac, who gave one of the first popular accounts of these discoveries (*Popular Science News,* February, 1902), remarked that "the drawing is wonderful," and that "we are justly astonished to find such artistic performances in times so distant from ours, and in which we did not suppose a like civilization." But the discoveries that have been steadily made during the subsequent decade have

only added to the astonishment of the world at these artistic performances so long hidden from our knowledge. A few words from the Cambridge University edition of the "Encyclopædia Britannica" will serve to show the verdict of modern scholarship on this point. We are told that these drawings "bring before us a race of artists of first-rate capacity,

FIG. 84 — Unfinished polychrome painting of two reindeer, showing how painting was combined with engraving. Cavern of Font-de-Gaume (Dordogne). 1-20. (After Capitan and Breuil.)

who for accuracy of observation, and for skill in indicating the character and peculiarities of the animals around them, have never been surpassed." (Vol. 2, p. 347.) But in addition to these life-size drawings and paintings, we have also some very remarkable sculpture work, of which this authority says:

If we are forced to marvel at the graphic skill of the cavemen, their sculptures in the round are on a still higher

plane, as may be seen in the figures of Reindeer in ivory in the British Museum. While they are not highly finished, they show a complete understanding of the animal's peculiar forms and contours, which are rendered in a direct, unhesitating way that should betoken a long period of artistic training and an executive power uncommon at any time. These drawings and sculptures have always been appreciated and even regarded as being of a much more advanced style than was to be expected among men who are always classed in the lower grades of culture. But enough stress has not hitherto been laid on the artistic quality of the work, which would

FIG. 35 — Red Drawing of *Rhinoceros tichorhinus*, from Font-de-Gaume. (After Capitan and Breuil.)

be considered fine at any time in the world's history. . . . There are many astonishing problems in archæology, but none so badly in need of solution.— *Ib., id.*

The accompanying cuts (Figs. 32-35) are taken from the Report of the Smithsonian Institution for 1909; but they can convey only a very poor idea of these drawings and paintings as they really are. Two plates in the "Encyclopædia Britannica," accompanying the article on painting (Vol. 20, p. 462, Plates 1 and 2) may serve to give a better idea of what they are like, also Plates 2 and 3 accompanying the article on archæology.

But we must now deal with the much more perplexing question of time. When were these drawings made? What people made them? On the accompanying diagram (Fig. 33), which is taken from the article by G. G. MacCurdy, in the Smithsonian Report for 1909, already referred to, these drawings are assigned to the Upper Palæolithic "period," which corresponds with the Upper Quaternary "period" of geology. These drawings are almost universally assigned to the Cro-Magnon "race," so named from a locality in Dordogne, France, where some skeletons were found in 1858. These people of Cro-Magnon and Menton were evidently almost a race of giants, some of them being seven feet tall, with a very extraordinary muscular development, as proved by their bones, while their skulls were large and well formed, and as even an out-and-out evolutionist admits, "their cranial capacity was above that of average Europeans of the present day." (N. C. MacNamara, *Nature,* March 7, 1901.) The skull of the Old Man of Cro-Magnon has a capacity of 1,590 cubic centimeters, or 119 cubic centimeters more than the average of 125 modern Parisian skulls, while this man had lived to so great an age that, though every tooth was sound, they had all been worn down to the very sockets.

Now if we decide that these Cro-Magnon people were the race who did the drawings on the walls of the caves, we are in effect assigning them to the Palæolithic period, which is a tolerably well-defined period of antiquity, or at least is separated from the

Neolithic period by a well-marked break that can not be ignored, while the latter period passes by insensible gradations into the modern period. Very likely we shall one day make a distinction between the age in which these men lived and the true geological period when that warm spring-like climate covered all the earth, making the so-called Ice "age" a local affair, confined to only a part of the world, and subsequent to the real geological age, the latter being thus extended to cover all the great geological changes in other parts of the world, including the Pleistocene, or Quaternary. But in the present state of our knowledge we are not able to do this effectively. Scientists universally associate these men of the caves with the Pleistocene fauna of Europe, making this Ice "age" the last of the true geological series, though in other lands where the Ice catastrophe did not extend, the Pleistocene blends with the Tertiary without any sharp line of distinction.[2]

Thus there is no valid reason, from the common view-point, for saying that these Cro-Magnon men were not contemporary with the fauna of the Plio-

[2] Stated in terms of Bible history, this would mean that these men of the caves were not really antediluvian, but only very early postdiluvian; that they were acquainted only by tradition with some of the animals they have depicted; and that where their bones are found along with those of the Elephant, Rhinoceros, etc., in the latitude of England and France, it is only because of the general mix-up that occurred at the time of this Ice catastrophe, which seems to have been an event quite subsequent to the other geological work. The whole question is at present in too complicated a state to admit of very definite solution; and on this account the author has preferred to use only the *argumentum ad hominem* which takes these geological distinctions and classifications as commonly understood.

cene or the Miocene. At least *some men were, as commonly admitted;* and why not these as well as any others? For if we admit that any human remains whatever are of real geological age, it is only a very artificial distinction that will separate "Glacial" Man from the men of the Middle Tertiary period. And in the name of common-sense science, if the human period is thus elastic enough to stretch out over the Pleistocene, the Pliocene, and clear back to the "Middle Miocene," why can't we do the same for all of Man's strange companions, the Mammoth and the Cape Hyena, the Reindeer and the Hippopotamus, the Lion and the Musk-ox, etc.? We used to hear a good many sneers about its being impossible for this apparently incongruous mixture to live side by side, and hence some writers described a "Mammoth age" and a "Reindeer age," and so on, *ad nauseam.* Since the discovery of these companion pictures of the Mammoth and the Reindeer side by side, to say nothing of the numerous instances where the bones of all these Pleistocene animals are found mixed indiscriminately together, we do not hear so much of this nonsense; still it is to be feared that it has not yet wholly disappeared. But just as diverse faunæ can now be found living within a short distance of each other in India, Africa, South America, or any other part of the tropical world where high mountains and low, moist plains exist side by side, it is the most reasonable thing in the world to suppose that these Elephants, Lions, and Hippopotami lived beneath the "Middle Ter-

tiary" Palms, Cinnamons, and Mimosas of the lower elevations, while the Reindeer, Musk-ox, and Glutton lived beneath the Maples, Birches, and Beeches of the high mountainsides.

As I have already remarked several times, the truly scientific attitude of mind would be to take all these types of life that now coexist in our modern world as living contemporaneously in that older world, *until we find positive evidence to the contrary,* and we all know that such evidence has never been brought forward. The burden of proof rests on those who declare that this ancient world, whose magnificent ruined relics we now find beneath our feet, was not just as *complete and harmonious a unit* in its plant and animal life as is our own. Things which are equal to the same thing must be equal to one another; hence the plants and animals that are now contemporary with Man may correctly and scientifically be associated with one another wherever we find them; therefore if human remains are found in Miocene beds as well as in the Pliocene and the Pleistocene, what line of logic will forbid the idea that Man and all his Pleistocene companions were really contemporary with the flora and fauna of the Middle Tertiary? There is absolutely no method of reasoning deserving to be called scientific to show that such was not the case; and as already remarked, inductive science must ever put the burden of proof on those who affirm that one of these sets of life lived before the other.

In reality the question is very simple: Are human

remains found in the real fossiliferous rocks? Is Man found fossil like the other animals? Geologists universally answer in the affirmative, and say that human remains have been found in the Pleistocene, the Pliocene, or even in the Middle Miocene rocks.

We may now proceed to inquire what geological changes have occurred since the "Middle of the Miocene," according to the accepted teachings of geology. We may consider these changes under three heads.

1. Our first point must be that of climate, and I have already given abundant evidence to show that at that "time" an abundant warm-climate vegetation mantled all the Arctic regions. As already quoted from Wallace, throughout the whole Arctic regions, and during the whole of geological time, "we find one uniform climatic aspect of the fossils," and "it is quite impossible to ignore or evade the force of the testimony as to the continuous warm climate of the north temperate and polar zones throughout Tertiary times."

That this astonishingly mild and uniform climate prevailed over these regions until and during the time of the Mammoth, we ought not to have a shadow of doubt. What single bit of positive evidence is there to show that it did not? That he must have had some such vegetation on which to feed is certain, and there is no proof of any previous interruption of these conditions save a series of hypotheses. He and his fellows browsed on semitropical and warm temperate plants far within the Arctic Circle, if there happened to be land there, doubtless over the very

pole itself; but suddenly, lo, something caught him with the grip of death —

> And wrapped his corpse in winding-sheet of ice,
> And sung the requiem of his shivering ghost.

Who has not read of their untainted meat now making food for Dogs and Wolves? Their stomachs are well filled with undigested food, showing, as one author remarks, that they "were quietly feeding when the crisis came." Dr. Hertz recently reported one not only with its stomach full of food, but with its mouth full, too. No wonder that even an orthodox geologist like Professor Dana is compelled to say that these things prove "that the cold finally became *suddenly* extreme, as of a single winter's night, and knew no relenting afterward."

Here then is one very notable geological event which has taken place within the human epoch, and the only thing of its kind of which geology has an undeniable record; namely, a sudden and radical change in the earth's climate, *a cosmic affair, and not a local phenomenon.* I need not here attempt to discuss the how of this world catastrophe as it must have been, or the other changes inseparably involved. The fact itself is as certain as Man's own existence.

2. The next division of our subject, in further consideration of the changes that have taken place since Man's existence, as stated at the beginning of this chapter, relates to the changes of land and water distribution since "Middle Miocene times." And here again I shall take the classification of these rocks just as I find them.

The first thing which impresses us is the extremely fragmentary distribution of the Miocene and Pliocene beds. Not, however, that they are uncommon or yet of small extent. On the contrary they are scattered over America and Eurasia — and all the rest of the globe for that matter — like the spots on a Leopard, or the warts on a Toad's back, till it becomes one of the unsearchable mysteries of the science how these innumerable patches can be got down under the ocean to receive their load of sediment, without deluging the surrounding regions in a similar manner. But then, to be sure, fresh-water lakes will answer the same purpose, and are particularly indicated (?) when the *proportion* of plants and terrestrial animals is in excess of the true marine fossils. And so enormous fresh-water basins are described here and there, with the great Mammals crowding about their margins in their zeal to become fossilized, that the mountain tops may be saved from going under once more — or perhaps I should say to enable the modern writers to get some of these strata puckered up to their full height before these "late" Tertiary deposits were made. This mountain-making business is another affair that geologists would like to have take place on the instalment plan, but unfortunately it seems to have been nearly all postponed till the very close of "geological time." This arrangement of fresh-water lakes saves the central Rocky Mountain region from going down again beneath the deep. But it can not save the Alps, Juras, and Apennines in Europe, nor the Hima-

layas and most of the other mountains in Asia, nor the coast region of California and Oregon in America, to say nothing of large parts of the Andes in South America, with regions in Africa and Australia.

But what is the use of trying to figure out the amount of our earth which has been under the ocean since "Middle Tertiary times," and thus since Man was upon it? To save the northern half of Europe with all of Canada from again going under at the close of the "Tertiary period," geologists have spread out their continental ice-sheets, and have asked them to do duty instead of water. But this is hardly sufficient, for the "upper" or "later" part of the so-called "Glacial" deposits are clearly stratified; and hence they either invoke a *"flood vast beyond conception,"* as Dana does in America for the "final event in the history of the glacier," or, as others prefer, the whole region is baptized again. As Dawson says in his "Meeting-Place of Geology and History," "No geological fact can be better established than the Post-Glacial subsidence."

But I must not weary the reader by dwelling on this monotonous repetition of catastrophes — for must they not have been catastrophic if such ups and downs of whole continents are crowded within the human period? We may allow a number of thousands of years for Man's possible existence, but archæology and history alike protest against the millions of years required to explain these continental oscillations on any basis of uniformity. One such period of horror ought to be enough for us, and to

understand or explain it in a truly scientific manner, we must with it correlate the sudden and world-wide change of climate already described.

3. One more point demands consideration ere we complete this subject of what Man has witnessed of geological change. For, according to current theory, *almost all the mountains have been either wholly formed or at least completed within quite "recent" times;* indeed, many of the greatest mountain chains have been puckered up from the position of horizontal strata beneath the sea wholly since "Miocene times," which for us means since Man was upon the globe.

Thus Dana, in speaking of the part of Western America which has been elevated since "Miocene times," says that it "probably included the whole of the Pacific mountain border, from the line of the Mississippi Valley to the Pacific coast line and outside of this line for one or more scores of miles." ("Manual," p. 364.)

And he adds the significant words:

> Contemporaneously, similar movements were in progress over the other continents: along the Andes, affecting half, at least, of South America; the Pyrenees, Carpathian Alps, and a large part of Europe; the Himalayas and much of Asia. —*P. 365.*

Let us now take a brief glance at a few of the details of what these mountains were thus doing while Man was living in semitropical England, or at least Western Europe.

In speaking of foreign examples of Tertiary moun-

tain making, this author devotes especial attention to the Alps and the Juras, for their structure is better understood, having been more carefully studied. And of an example described by Heim, already spoken of, he says:

One of the overthrust folds in the region has put the beds upside down over an area of 450 square miles. Fifty thousand feet of formations of the Jurassic, Cretaceous, Eocene Tertiary, and Miocene Tertiary, were upturned *at the close of the Miocene period.— P. 367.*

With what a whack must this mighty mass of rocks have fallen on itself — miles in thickness, and turned "upside down over an area of 450 square miles"!

Of course I am here taking the record just as I find it, as I have already discussed this matter of "overthrust folds."

I need not give further examples from the other great mountain ranges. Their structure is not so well understood as that of the Alps, though doubtless when examined they will be found just as "young," and just as full of astonishing mountain movements, as those already examined. But this much is already certain,— that practically over all the world the mountains were either completed or wholly raised from the sea-level during "late Tertiary" and "early Quaternary time." No wonder Dana says that this fact "is one of the most marvelous in geological history."

It has been thought incredible that the orographic climax should have come so near the end of geological time, instead of in an early age when the crust had a plastic layer beneath,

and was free to move; yet the fact is beyond question.—*"Manual," p. 1020.*

I think I have now abundantly proved the various heads of the proposition with which I began this chapter, taking them in reverse order; namely, that even from the standpoint of the current theories:[3]

1. Man must have seen the entire elevation or at least the completion of practically all the great mountains of the world, such as the Rockies, Andes, Alps, Carpathians, Caucasus, Himalayas, etc.

2. The relative distribution of land and water surface has — since Man's advent as commonly stated — changed completely. The land and water have practically changed places over the greater part of the globe.

3. Man lived while the Arctic regions had a mild,

[3] In this discussion I have purposely ignored the various instances where human remains have been reported from deposits of even greater "antiquity" than the Middle Tertiaries. For instance, there was published anonymously in 1857, by Judd & Glass, London, a book entitled *"Voices from the Rocks; or Proofs of the Existence of Man during the Palæozoic or Most Ancient Period of the Earth."* This book was carefully and candidly written in the light of the best knowledge then obtainable, for it was during the very heat of the discussion as to whether or not Man is ever found in the fossil state.. Some of the examples there recorded have since been "explained" in one way or another, while others have been ignored entirely. Other reports of human remains having been found in Palæozoic or Mesozoic rocks appear now and then, but are soon laughed out of countenance by scientific ridicule, and never find their way into orthodox scientific literature. The following words, quoted from the book mentioned above, are just as pertinent to-day regarding the attitude of the current geology toward new facts that disagree with the popular theories: "These discoveries are so clear and incontrovertible that impartial inquirers after truth are amazed at the obstinacy with which geologists persist in shutting their eyes to the real facts in the case. The world affords no parallel to such conduct, unless, perhaps, that of the Church of Rome in reference to the discoveries of Galileo." (Page 142.)

soft climate, and he lived to see these conditions so suddenly changed that some of his dumb brute companions were caught in the waters and frozen so speedily that their flesh has remained untainted. Other considerations show this change of climate to have affected the whole globe.

The lesson to be drawn from this fact about fossil Man as the last fact in the line of cumulative evidence relating to the fossil world, will be considered in the following chapter.

# CHAPTER XIII

## Scientific Methods

In Part One of this book I tried to examine into the facts and methods which are commonly supposed to prove that there has been a succession of life on the globe. We found that this life succession theory has not a single fact to support it; that it is not the result of scientific research, but wholly the product of an inventive imagination; that no one kind of fossil has ever been proved or can be proved to be intrinsically older than another, or than Man himself; and hence that a complete reconstruction of geological theory is imperatively demanded by our modern knowledge.

In short, that ancient world whose ruins we now have as fossils was a *unit,* and simply an older state of our present world. All the important groups of living plants and animals have now been found as fossils, and their classification does not represent a time value in the one case any more than in the other. The geological series of fossils represents merely taxonomic relationships, just as would a similar arrangement of the living species, nothing more.

In Part Two the following additional facts have been brought out:

1. The abnormal character of much of the fossiliferous deposits.

2. A radical and world-wide change of climate.

3. The marked degeneration in passing from the fossil world to the modern one.

4. The fact that the human race, to say nothing of a vast number of living species of plants and animals, has participated in some of the greatest of the geological changes — we really know not how to limit the number or character of these changes.

These additional facts still further emphasize the unity or solidarity of that ancient world. They show how all its parts are indissolubly bound together in a common fate, and how sharply and distinctly it is differentiated from our modern world by an impassable boundary-line of world-wide geological changes that true science can never ignore.

Surely a true spirit of scientific investigation would now begin to inquire, *How did these changes take place?*

In any truly heuristic or Baconian study of geology as a whole, the rocks of the so-called Glacial age and the Tertiaries, *the surface rocks* (at least on the surface in England and Germany where first examined), will not be, as Zittel says they have been, "the last to be understood," and only attacked after geological history had been started away back in eternity, and all the details of the successive ages had been arranged according to the doctrine of uniformity and *a priori* methods of reasoning, with the very natural result that, failing to make a good

splice of these two ends of our slipshod investigations, we have for over half a century been laboring under a "glacial nightmare," and these deposits on the very top of the ground "still remain in many respects the despair of geology."

But there is no science in all this. Is it scientific to start with what we know the least about, and force our more accurate knowledge of things at hand to square with our theories of things more remote? The current geology has never used a trace of sound Baconian science in these fundamental principles and methods, but, as a burlesque on inductive science, has always started with *some hypothetically oldest forms,* and after having located them at the vanishing-point of the vistas of a past eternity, has trusted to its skill in dead-reckoning to be able to work up by slow stages to the present, and to arrive here with a sufficiently small cargo of "living" species undisposed of to splice on to the present smoothly and safely on the basis of uniformity and slow secular change. Such is geology by hypothesis,—from the subjective standpoint. It is a kind of "science" by which some people have for a century or so tried to explain the known in terms of the less known or the unknown. Such are the methods "which dominated mediæval scholasticism and made it so barren."

It requires no scientific instruments of precision to recognize in all this a mere travesty on the methods of Bacon and Newton, and it requires but little training in the latter to suggest the better

way. Let us throw to the winds all speculations as to how the world was made, and hold our restive imaginations within the bounds of legitimate science by the strong rein of demonstrable fact, content if we can really explain a few things that have happened since the beginning. And let us start with the most obvious facts on hand, namely, *Man and all the living species of plants and animals;* and with all inherited prejudices about "extinct species" cast aside, by working back among the strata, let us find where and how their fossils occur, and then decide as best we can how they were placed there, and how the intervening changes took place. Focusing all of our powers on all the human remains of real geological age wherever found, and on the fossils of all species of plants and animals now living anywhere on earth, let us, with all the known facts of biology, palæontology, and meteorology, endeavor to reconstruct the flora and fauna of that ancient world and the marvelously uniform climate in which they lived. And after having thus obtained a good, broad view of the fossil world as a whole, we may possibly be prepared to determine how that almost Eden-like world was transformed by a sudden and awful catastrophe into this wholly different modern world with which we are familiar. Then, *whatever rocks we have left over* after these things are decided, we may very safely assign to the indefinite and (in a scientific way) indeterminable period of the earth's previous existence. This is the only method fit to be termed scientific.

Surely it is little short of absolute nonsense to begin somewhere away back in eternity, and, contrary to our universal modern experience, dogmatize about certain times back there when there were no zoological provinces and districts, but only one and the same assemblage of living creatures everywhere on earth, and on the strength of this monstrous assumption formulate our pretty theories as to how this deposit was made, and how that was laid down, and the exact order in which they all occurred; while these "recent" deposits, in which our race and all our companion plants and animals are acknowledged to be concerned, are left over till the last, and we then find that the two are incommensurable, and, as Howorth and Suess have so clearly shown, can never be made to splice onto our modern conditions. Thus we ourselves, to say nothing of thousands of living species of plants and animals, have participated in some of the very greatest of the geological changes,—we know not how many or how great. *These things should first be explained.* Has anything happened to our world that will explain them? Are there known forces and changes now in operation which, granting time enough, will amply and sufficiently explain these facts as simply one in kind with those of the present day?

To this last question we must admit that our historic experience, prolonged over several thousand years, utters a thundering NO! Volcanoes are every now and then breaking forth; but volcanoes and mountain ranges have nothing in common with one

another as to structure and origin. No one claims that a single mountain flexure is now being formed or has been formed within the historic period; while, as Suess remarks, "the formation of mountains evidently belongs to *quite another series of phenomena*" from the great exchanges of ocean and dry land that once took place. ("The Face of the Earth," Preface 5.) There are indeed "creeps" in the rocks in certain places, but these are not such as to contribute to the height of the mountains in which they occur, but rather the reverse. Sudden changes of level within small areas have occurred, but neither in extent nor in kind do they furnish any key as to past changes of level; while the so-called "secular" changes are so microscopic in amount and so ambiguous in character that they are utterly unworthy of consideration in view of the tremendous problems which we are trying to explain. Indeed, the great work of Eduard Suess has demonstrated conclusively that, to quote his own words, "the theory of the secular oscillations of the continents is not competent to explain the repeated inundation and emergence of the land" (Vol. 2, p. 540); for even in those localities, like Sweden and Greenland, which have been supposed to be rising or falling, "displacements susceptible of measurement have not occurred within the historic period." (Vol. 2, p. 497.)

In fact, this most accomplished scientist, after summing up the whole wisdom of modern science on

these subjects, writes the epitaph of the old uniformitarianism in such language as the following:

> Thus, as our knowledge becomes more exact, the less are we able to entertain those theories which are generally offered in explanation of the repeated inundation and emergence of the continents.—*Vol. 2, p. 295.*

Any comment of mine on these words ought to be superfluous.

As for climate, I never heard any one suggest that cosmic changes of climate are now known to be going on, much less that sudden changes of the kind indicated by the North Siberian "mummies" are in the habit of occurring. In fact, we must all own that the mountains, the relative position of land and water, as well as the climate of our globe, are each and all now in a state of stable equilibrium, and have been in this state since the dawn of history or of scientific observation.

Accordingly I ask, *How much time is needed* to account for the facts before us on the basis of this bankrupt uniformity? Indeed, will a short eternity itself satisfy the stern problem before us? I can not see that it holds out the slightest promise of solving it; while, on the other hand, I am sure that, in dealing with the past of Man's existence (theories of evolution and all other theories of origins whatever cast aside), we are not at liberty to make unreasonable demands on time. The evidence of history and archæology is all against it.

From the latter sciences it can be shown that at their very dawn we have, over all the continents,

a group of civilizations seldom equaled since, except in very modern times, and all so undeniably related to one another and of such a character that they prove a previous state of civilization in some locality together, before these scattered fragments of our race were dispersed abroad. We can track these various peoples all back to some region in Southwestern Asia, though the exact locality for this source of inherited civilization has never yet been found, and it is now almost certain that it is somehow lost in the geological changes which have intervened. For when we cross the well-marked boundary-line between history and geology, if the palæolithic remains of Western Europe are really of geological age, we have still to deal with men who apparently were not savages, men who with tremendous disadvantages could carve and draw and paint as no savages have ever done, and who had evidently domesticated the Horse and other animals. But as to time, history gives no countenance to long time, that is, what geologists would call long. Authentic history extends back a few score centuries, archæology may promise us a few more. As for millions of years, or even a few hundred thousands, the thing seems too absurd for discussion, unless we forsake inductive methods, and assume some form of evolution *a priori,* and contrary to all experience and all the evidence.

At any rate, as we have seen, human remains are found fossil just the same as other forms of life, and there is absolutely no way of proving that these

fossil men are not as old as any other fossils. Whatever proves the latter old does the same for Man; but if we insist on the comparatively "modern" character of these fossil human remains, we must admit the same for all the other fossils, because inductive science insists that the fossil world was a unit, and that man must have been contemporary with all alike. True science can never take us back of this state when all existed contemporaneously; for it would require a supernatural knowledge of the past to discriminate among the fossils, and say that one particular group existed before the others and occupied the world exclusively for ages before they came into existence. As we have seen, all efforts thus to lay out a history of organic creation as Cuvier's "glorious" vision pictured it to him, have ended in a miserable failure, because such efforts are along lines so false that they are rapidly making geology a laughing-stock to the other sciences founded on the principles of Bacon and Newton. *The fossil world is a unit, and simply represents the ruins of an older state of our present world; and whatever geological changes they indicate, must have taken place since Man was on the earth, for there is no possible line of scientific reasoning to convince us that any single type of fossil is older than the human race.*

Hence it ought to be evident that no amount of learned trifling with time will solve our problem without supposing some strange event to have happened to our world and our race, long ago, and be-

fore the dawn of history. I see no possible way for scientific reasoning to avoid this conclusion. Ignoring for the present the Chaldean Deluge tablets, and what Rawlinson calls the "consentient belief" in a world-catastrophe "among members of all the great races into which ethnologists have divided mankind," which like their civilization has the hall-marks of being *an inheritance* from some common source before their dispersion, we may note that most geologists now admit the certainty of some sort of catastrophe since Man was upon the earth. I might mention Quatrefages and Dupont, Boyd Dawkins, Howorth, Prestwich, Wright, and Sir William Dawson, with many others. Even Eduard Suess teaches a somewhat similar local catastrophe, though like the others only as a reluctant concession to the insistent demands of Chaldean history and archæological tradition. But all of these affairs are mere makeshifts in view of the tremendous demands of the purely geological evidence, and all alike (save perhaps those of Wright and Howorth) labor under the strange inconsistency of supposing that such an event could occur without leaving abundant and indelible marks upon the rocks of our globe; while in view of the evidence given through the previous pages, I insist that the purely geological evidence of a world catastrophe is immeasurably stronger than that of archæology, that in fact the whole of the geological phenomena constitute a cumulative argument of this nature.

But if this be granted, we must then inquire,

What was its nature? and what its extent? The former is quite easily answered; the latter problem is still somewhat beyond our reach.

As to its character, the evidence is very plain. It was a veritable cataclysm of some sort; it deals with great changes of land and water surface. If the life succession is but a hoary myth, and if it turns out that we find countless modern living species of plants and animals mixed up in all the "older" rocks, we can not ignore these in a rational and unprejudiced reconstruction of the science. But, ignoring these, we must remember that *even the Tertiary and Post-Tertiary deposits are absolutely world-wide, and are packed with fossils of living species.* Not a continent and scarcely a country on the globe but contains great stretches of these latter deposits, laid down by the sea where now the land is high and dry. The sea and land have practically shifted places over all the globe since Man and thousands of other living species left their fossils in the rocks. It is only the stupendous magnitude of these changes which has made our scientists reluctant to admit the possibility of such a catastrophe.

With the myth of a life succession dissipated, a broad view of the fossil world can not fail to convince the mind of the reality of some such cosmic convulsion, and convince it with all the force of a mathematical demonstration. Great groups of animals have dropped out of sight over all the continents, and their carcasses have been buried by sea water where we now find high plateaus or mountain

ranges. Ignoring again for the moment the abundant fossils in the so-called "older" rocks, and fixing our attention entirely on the Tertiary and Pleistocene beds that are acknowledged to be closely connected with the human race and the modern world, we still have a problem in race extinction alone that appals the mind. The Mammoth, Rhinoceros, and Mastodon, together with "not less than thirty distinct species of the Horse tribe," as Marsh says, all disappear from North America at one time, and the most ingenious disciple of Hutton and Lyell has been puzzled to invent a plausible explanation. But when we consider that at this same "geological period" similar events were occurring on all the other continents — the huge Ground-sloths (Megatheriums) and Glyptodons in South America; "Wombats as large as Tapirs," and "Kangaroos the size of Elephants," in Australia; the Mammoth and the Woolly Rhinoceros in Eurasia; together with an enormous Hippopotamus, as far as England is concerned, to say nothing of those great Bears, Lions, and Hyenas, with a semitropical vegetation, *all disappearing together at the same time,* or shifting to the other side of the world — it becomes almost like a deliberate insult to our intellectual honesty to be approached with offers of "explanations" based on any so-called "natural" action of the forces of nature. But when, in addition to all this, we consider the fact that those human beings of the deposits of Western Europe were contemporary with the animals mentioned above, and disappeared along with them at this same time,

*while mountain masses in all parts of the world crowded with marine forms of the so-called "older" types positively can not be separated in time from the others,* it becomes as certain as any other ordinary scientific fact, like sunrise or sunset, that our once magnificently stocked world met with some sudden and awful catastrophe in the long ago; and is it in any way transgressing the bounds of true inductive science to correlate this event with the Deluge of the Hebrew Scriptures and the traditions of every race on earth?

We have already seen how Dana supposes *two* other such events, one at the close of the "Palæozoic age," and the other at the close of the "Mesozoic," merely to account for the astonishing disappearance of species at these periods when the fossils are arranged in taxonomic order; but if we once admit one such event *with Man and all the other species contemporary with one another,* where shall we limit its power to disturb the land and water and churn them all up together, leaving the present simply as the ruins of that previous world? Or how shall we proceed on sound scientific principles to discriminate between the extinct fossils that may have had to run the gauntlet of such an aqueous convulsion, and decide that only a certain limited few of them had their extinction due to this event, and then tabulate the others off on the percentage system as if such a catastrophe had never happened? The fact is, the current geology is wholly built up from the Cambrian to the Pleistocene on the *dogmatic denial*

that any such catastrophe has occurred to the world in which Man lived, for *one* such event happening in our modern interdependent world is enough to make the whole pretty scheme found in our text-books tumble like a house of cards. Like the patient and exact observations of the Ptolemaic astronomers, which accumulated volumes of evidence contradicting their own theories, and which in the hands of Copernicus and Galileo, Kepler and Newton, sealed the doom of astronomical speculation and laid the foundations of an exact science of the heavens; so have the indefatigable labors of thousands of geologists accumulated evidence which strikes at the very foundation of the current uniformitarianism, and casts a pall of doubt over every conclusion as to how or when any given deposit of the "older" rocks was produced.

Here inductive science must leave the question for the present. The possibility of such a world-wide catastrophe, which might account for the major part of the geological changes, needs no apology here. The slightest disturbance of the nice equilibrium of our elements would suffice to send the waters of the ocean careering over the land; and in the abundance of astronomical causes competent for such disturbance, we cease to regard such an event as necessarily contrary to "natural law." The possibility of such a thing no competent scientist now denies; it is the problem of *recovery* from such a disaster which makes the perplexity. But incredible or not as the latter may be regarded, I claim to have established

a perfect chain of scientific argument proving a world-wide catastrophe of some sort since Man was upon it. But this fact, if once admitted, strikes at the very foundation of the current science, and bids us readjust our theories from this view-point. The venerable scheme of a life succession *becomes only the taxonomic or classification series of the world that existed before this disaster,* and it becomes the business of our science to try to find out how many and what deposits were due to this event, and what were accumulated during the unknown period of previous existence. Those of us who wish to speculate can then let our imaginations have free play as to the uncounted ages before that event; but the "phylogenic series" as a rational scientific theory is in limbo forever. Inductive geology, therefore, deals not with the formation of a world, but with the ruins of one; it furnishes us no materials for constructing a cosmogony, that is, nothing as to the details or order in which Creation took place, though, as we have seen, it indirectly proclaims the general fact of a literal Creation in no uncertain tones.

But this latter problem lies across the boundary-line in the domain of philosophy and theology, and to these systems of thought we may cheerfully leave the task of readjustment in view of the facts here presented. A few disconnected thoughts along these lines I have ventured to insert here, not strictly as a part of my purely scientific argument, but as an appendix.

# APPENDIX

# APPENDIX

## Reflections

In the preceding pages the author has endeavored to develop a scientific argument pure and simple. He has purposely restrained it in many ways, and has tried to be quite conservative in urging the absolutely demonstrative character of the evidence of a great world catastrophe similar to that described in the Bible as the Flood. But these contemporary documents, taken from the rocky pages of nature's diary, which thus become such conclusive vouchers for the Biblical story of the Deluge, compel us to go back of all this and face the problem of Creation itself; for if this world catastrophe has intervened, and if we can not be sure that one type of life is older than another, inexorable logic will compel us to acknowledge the great fact of a literal Creation of doubtless all the various distinct types of life (Man included) at approximately one time.

Hence the author does not feel called upon to apologize in any way for attempting now to show the connection between an inductive scheme of geology as set forth in the body of this work and the religion of Christianity; though our remarks along this line must necessarily be very brief.

The most fundamental idea of religion is the

fatherhood of God as our Creator. The only true basis of morality lies in our relationship to Him and to His universe as His creatures. During the latter half of the nineteenth century the Biblical idea of a Creation at some definite and not very remote period in the past became much modified by reason of certain theories of evolution, which explained the origin of plants and animals as the result of slow-acting causes, now in operation around us, prolonged over immense ages of time. These theories, though built up wholly on the current geology as a foundation, were yet supposed to be firmly established in science, and after a spirited discussion among biologists for a few years, were almost universally accepted in some form or other by the religious leaders of Christendom. And though the "theistic evolution" of recent years may be supposed to have modified somewhat the stern heartlessness of pure Darwinism, it still leaves the Christian world quite at variance with the old Biblical doctrines regarding good and evil, Creation, redemption, the atonement, etc.

And these are not the only effects of the general acceptance of these ideas as an explanation of the origin of things. We see their moral effects in the generation now coming on the stage of action — men educated in an atmosphere of evolution, and accustomed from youth to the idea that all progress, whether in the individual or the race, is to be reached only by a ceaseless struggle for existence and survival at the expense of others. In the words of Sir

William Dawson, these doctrines have "stimulated to an intense degree that popular unrest so natural to an age discontented with its lot . . . which threatens to overthrow the whole fabric of society as at present constituted." ("Modern Ideas of Evolution," p. 12.)

This popular and perfectly natural application of the evolution doctrine to every-day life is certainly intensifying, as never before, the innate selfishness of human nature, and, in every pursuit of life, embittering the sad struggle for place and power. Perhaps no other one cause and result serve more plainly to differentiate the present strenuous age from those that have gone before. The hitherto undreamed-of advantages and creature comforts of the present day, instead of tending toward universal peace and happiness, are apparently only giving a wider range to the discontent and depravity of the natural human heart; so much so, that any one familiar with the history of nations can not but feel a terrible foreboding creep over him as he faces the prospect presented to-day by civilized society the world over.

The only remedy for the many and increasing evils of our world is the old-fashioned religion of Christ and His apostles,— and this applied, not to the state, but to the individual. The soul-regenerating truths of Christianity have always, wherever a proper test has been given them by the individual, resulted in moral uplift and blessing. Ecclesiastical policies and ideas have always, wherever allowed

to influence civil legislation, resulted in oppression and tyranny.

What has geology to do with all this? — It has much to do with it. Correct ideas of geology will remove a great many vain notions — I had almost said superstitions — regarding our origin, which now pass under the name of science. And in thus removing false ideas, it leaves the ground cleared for more correct ideas regarding Creation, and thus for truer concepts of morality, the old idea of "must" and "ought" based on our relation to God as His creatures.

Mark the words here used. I say it "leaves the ground cleared" for truer ideas of Creation; because inductive geology must not be expected to teach us anything about the how or even the when, but only the general fact of a real Creation *essentially different from anything now going on.* This is the utmost limit of any physical science. Seemingly every possible scheme of cosmogony has been attempted in ancient or in modern times, except the Christian one that all things animate and inanimate stood up before Jehovah at His word. True inductive science has refuted one after another of these man-made schemes or perverse guesses, the last to be proved false being the evolution theory, which is still believed by many. But the limits of any true natural science are reached when it removes these false ideas. It can not demonstrate just how Creation was brought about; it can only prove how it was not. But though there may be possible an

infinite series of false schemes of Creation, and though it may be said to be impossible to prove every single instance of an infinite series wrong, yet they are all so essentially similar, that, having proved so many false, it is safe to say that inductive geology, in destroying forever the succession-of-life idea, demonstrates the truth of the only possible alternative, namely, *Creation as the definite and immediate act of the infinite God.* Before this awful but sublime fact, looming up against the dawn of time as the fogs of evolution and cosmological speculations clear away, the human mind stands to-day as never before within historic times.

With a fairly complete knowledge of the chemical make-up of protoplasm, with a good acquaintance with the life history and reproduction of living cells, we yet know nothing of the origin of life. With a good working knowledge of variation, hybridization, etc., we know nothing of the origin of the various kinds of life. While with a fairly good understanding of the present geographical distribution of plants and animals, and of where their fossils occur in the rocks, we are profoundly ignorant of any particular order in which these forms originated on our globe, or whether they all took origin at approximately one and the same time. In short, having reached out along every known line of investigation, until we have apparently attained the limits of the human powers in investigation and research, twentieth century science must stand with uncovered head and

bowed form in presence of that most august thought of the human mind, "*In the beginning God created.*"

In other words, we do not know how life could originate from the not-living except by a direct Creation. And since scientific observation has never yet shown us a single example of a distinct kind of life[1] arising from another kind, and especially since we now know that geology can not show us that the various lower forms of life lived on the earth for ages before the higher forms, we can not believe that any distinct type of life, low or high, could originate except by a direct Creation. The higher forms could not grow out of the lower any easier than the lower could arise from the not-living. The higher forms demand a Creator just as much as the first speck of protoplasm; and for aught we can now see, all the various forms of life were doubtless created at approximately the same time.

Personally, I do not feel that we need speculate as to *how* Creation was accomplished. Perhaps with

[1] De Vries and others have shown how ordinary or taxonomic species as usually characterized by science can originate by "mutation." This may explain the origin of a large fraction of the 25,000 Vertebrates, the 22,000 Mollusks, the 200,000 Arthropods, etc., as existing in our modern world, for the more variation we admit the easier it is to explain how the modern world could have grown out of the ruins of that ancient one. But they are not all species that are called species; for though these so-called new "species" of De Vries may perpetuate themselves, and even under some conditions maintain their seemingly fixed characters, yet there is no evidence of their coming up to the physiological test demanded by Huxley and all the best authorities of being themselves indefinitely fertile, and at the same time cross sterile with all others. These new species that have thus originated by scientific experiment may be as good species as any recognized by taxonomists; on that point I have nothing to say. But they are not new forms or new kinds in the sense intended in the text. See also Note on page 54 of this volume.

all our science we would not be able to understand such a work even if the Creator Himself were to undertake to explain it to us. And yet, while I do not consider it a very promising field for research, we ought to have no more reluctance, *per se,* to consider the manner in which the first cell or the first species was formed, than the way in which a chicken is now produced from the egg. But as a concession to those of my readers who are impatient at any of the closed doors of science labeled "No Admittance," I give the following suggestions as a possible explanation of the subject, or until we know more about it. They are from the author's former book, "Outlines of Modern Science and Modern Christianity":

We are getting no nearer the real mystery in the case by saying that all the tissues of the chick are built up by the protoplasm in the egg. The protoplasm in the toes is the same as that in the little creature's brain. Why does the one build up claws and the other brain cells? Does memory guide these little things in their wonderful division of labor? But they all started from one original germ cell, hence they all ought to have the same memory pictures. Or have they entered into a mutual benefit arrangement, like the members of a community, as Haeckel would have us believe, each contributing by actual desire and effort, I suppose, an individual share to the general progress of the whole? — No; they have all the appearance of being mere automata working at the direct bidding of a Master Mind. Every step of the process needs a Creator, just as much as the first cell division. In the words of one of the highest of scientific authorities, "We still do not know why a certain cell becomes a gland cell, another a ganglion cell; why one cell gives rise to a smooth muscle fiber, while a neighbor forms voluntary muscle;" and this also "at certain, usually predestined, times in particular

places." ("Nature," May 23, 1901, pp. 75, 76.) And in the same way the idea of a Creator would not be disposed of, even if we could possibly hit upon the probable process of world formation. We would not, by understanding the process, really get at the cause of the phenomena, any more than we do now at the real cause of life. From the scientific method the real mystery remains as much behind the veil as ever before.— *Pp. 111, 112.*

The origin of life must ever remain a great mystery, for nothing at all like it is now going on. And yet it could not well have been otherwise than by some orderly or "natural" process. Do we understand all natural processes? At some time life was not in existence on our globe. All agree that it had a beginning. Even if spoken into existence by the word of the great Creator, the living was at some time formed from the not-living or the not-material. It does not take even Huxley's famous "act of philosophic faith" to believe that. So that, in spite of all the haze that has been thrown around this question, the Biblical Creation of life is just as "scientific" as is evolution or any other theory, and no more contrary to or even outside of "natural law" than are they, though it is obvious that this first Creation of life was radically different from the manner by which life is reproduced and sustained to-day. It is in this sense that "the works were *finished* from the foundation of the world" (Heb. 4:3), for we have nothing now going on by which to judge of the manner or process of the creation of life.

Again I quote from this same work:

But see what we avoid. According to the Bible, death in even the lower animals (and consequently all misery and suffering — the less is included in the greater) is only the result of sin on the part of man, the head of animated nature, a reflex or sympathetic result, if you will. But with evolution we have countless millions of years of creature suffering, cruelty, and death before man appeared at all, cruelty and death that . . . have no moral meaning at all, save as the work of a fiend creator, or a bungling or incompetent one. — *P. 116.*

The author then gives a quotation from Le Conte, illustrating the extremely various ways in which matter and energy act on the different planes of their existence, while "the passage from one plane upward to another is not a gradual passage by sliding scale, but at one bound. When the necessary conditions are present, a new and higher form of force at once appears, like birth into a higher sphere. . . . It is no gradual process, but sudden, like birth into a higher sphere." ("Evolution and Religious Thought," pp. 314-316.)

The argument then proceeds as follows:

The living at some time originated from the not-living. *We call it Creation.* Can any one find a better name? It is preposterous to call it a process of development or evolution due to the inherent physical and chemical properties of the atoms, and effected by them alone. And it is equally absurd to try to make it appear as a mere incident in a scheme of uniformity, identical with what is now going on. *There is nothing like it now going on anywhere on earth.* And yet it is doubtless as much in harmony with the basic laws of the universe as are the invariable and exact combinations of chemistry. We do not understand the ultimate reasons for chemical affinity any more than we do for gravitation. They are only expressions of the methodical, order-loving

mind of Deity. Creation was only another action of the same mind, and we are not really finding any new difficulty when we say that the processes or the reasons for creative action are beyond our comprehension. When we can really solve some of the myriad problems right before our eyes, it will be time enough to complain about Creation being incomprehensible or contrary to "natural law."

Remembering, then, that, even according to Huxley's "act of philosophic faith," the origin of the living from the not-living must at some time have taken place, *why should we suppose that such a process was confined to one example?* If, when the young planet "was passing through physical and chemical conditions which it can no more see again than a man can recall his infancy," the "necessary conditions" were favorable for one such creation of life, *why not a few billion?* Would the production of a few billion such beginnings of protoplasm be any less "natural" than of one alone? Remember, however, that the arrangement of these "necessary conditions," as well as the endowing of matter with these "properties," not only requires a *cause,* but this cause must be *intelligent,* for there is indisputable design in this first origin of life.

The food for the development of this first embryo might, for aught that we know, be conveyed to it direct from the ultimate laboratories of nature, and it thus be built up by protoplasm in the usual way, without the medium of a parent form — other than the great Father of all. Or would it be any less according to natural law to believe that a Bird passed through all the usual stages of embryonic development from the not-living up to the full-fledged songster of the skies *in one day* — the fifth day of Creation? *And if one example, why not a million?* For remember that the youthful earth was then passing through strange conditions, "which," as Huxley says, "it can no more see again than a man can recall his infancy."—*"Outlines," etc., pp. 119, 120.*

Omitting some remarks about embryology, I continue this quotation as follows:

But what "law" would be violated in this springtime of the world if, instead of twenty years or so for full develop-

ment, the first man passed through all these stages *in one day* —the sixth of Creation week? He might as well have originated from the not-living as the evolutionist's first speck of protoplasm, for he certainly now starts from a mass of this same protoplasm, identical, as we have seen, in all plants and animals.

And by originating thus, he would escape that horrible heritage of bestial and savage propensities which he would get through evolution, a heritage that would make it not his fault, but his misfortune, that sin and evil are in the world, and that would also shift the responsibility for the evidently abnormal condition of "this present evil world" from the creature to the Creator, and change to us His character from that of a loving Father, fettered by no conditions in His creation, to that of either a bungling, incompetent workman or a heartless fiend; for, though I am almost ashamed to write the words, the god of the evolutionist must be either the one or the other.— *P. 121.*

The most firmly established result of modern biology is that the living can not originate from the not-living except by a veritable miracle, or in other words, a direct Creation. Nor can a distinct, new kind of life originate from another kind. Neither of these processes is now going on in our modern world, as all acknowledge. And now in the light of the facts brought out in the previous pages, inductive geology assures us that the lower forms of life did not live on the globe for ages before the higher forms; and hence in a twofold sense it is unscientific folly to talk of the higher forms having developed out of the lower. A direct Creation is the unavoidable conclusion of every rational mind, and a direct Creation for the higher forms as much as for the very lowest; and it is in the highest degree

reasonable that all the various distinct types of life were created at approximately the same time. *For since life demands a real Creation, since each separate kind demands a real Creation, and no one kind can be proved to be older than another, why is not a literal Creation of all the forms of life at approximately one time demonstrated as a scientific fact for every one capable of logical reasoning?* Nothing less than this can now be regarded as the net results of modern science.

In a very similar way chemistry and physics have long been pointing us backward to the same period for the origin of all that they can tell us. The grandest generalization of the former science is that *matter* is not creatable by any natural or artificial means. This is the doctrine of the conservation of matter. About the middle of the nineteenth century the same general truth was discovered regarding *energy,* and we now have the doctrine of the conservation of energy as the grandest generalization of physics, and one of the most magnificent in all science. A few decades later, Pasteur demonstrated for all coming time that *life* is not now originating from the not-living by any agency known to man. *Thus matter, and energy, and life are not creatable by any means within our knowledge.* And now geology, when allowed to give her testimony in a thoroughly scientific fashion, testifies to the same general truth regarding the great groups of plant and animal forms, like physics and chemistry pointing backward along the great perspective of the ages

to the same vanishing-point, already charted long ago in the Christian Bible as the birthday of the world.

WITH AN APPRECIATION NURTURED BY CENTURIES OF STUDY OF GOD'S LARGER BOOK, BAFFLED OFTEN THOUGH SHE HAS BEEN, AND DISAPPOINTED MANY TIMES IN THE WORDS SHE HAS ENDEAVORED TO SPELL OUT, SCIENCE TO-DAY PROCLAIMS ITS SUBJECT, ITS TITLE-PAGE, WHICH SHE HAS NOW AT LAST DECIPHERED, "IN THE BEGINNING GOD CREATED THE HEAVEN AND THE EARTH."

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